TECHNOLOGY REVIEW

January 1959

TECHNOLOGY DEPT.

V.61 #3

No. 11 in a series

Right off the Wire

Before the first nuclear-powered merchant vessel is launched, a new reactor system which has been designed is expected to reduce the cost of a comparable installation by forty per cent.

After leaving a new electric shaver plugged into an outlet overnight it can be used for a week without recharging.

A radio operator's vest, with pockets for dry cells, can be worn under outer garments in arctic cold. The batteries, when kept warm by body heat, are said to last ten times longer.

Automobile batteries are now made with cells which can be removed and replaced in a few minutes.

A new electronic surveying technique, now in use in highway layout work, enables engineers to establish numerous ground control points and measure distances in a matter of minutes. Maximum possible error is only 11 inches in 40 miles.

Copper strip is being made from powdered metal. The process can also be used for other metals which can be combined in no other way.

A portable building for use in the arctic has hollow walls of nylon fabric. When the walls are inflated the building stands erect.

A research program has begun for the study of new semiconductors for use in transistors. The materials are indium phosphate, gallium arsenide, aluminum antimonide.

An insulated guard rail for the end of the boom is made to protect a crane operator in case of contact with a power line.

More and better rayon is the object of a study of cellulose growth in living trees. Two-year-old pines are injected with radioactive carbon and are later cut down for examination.

A new plastic adhesive used in aircraft construction is semi-elastic and stronger than the metals it joins.

A new titanium alloy is made into sheets that will withstand air pressures of over 100 tons per square inch.

The "world's loudest noise" can be produced by a new compressed air loud speaker that is capable of projecting the human voice for ten miles.

Further information on these news items and on Simplex cable is available from any Simplex office. Please be specific in your requests.

Twelve pneumatic tires, each supporting a load of 20,000 pounds, enable a new lift to pick up and move concrete pipe sections at five miles per hour.

The Post Office Department has awarded a contract for the development of a mechanical letter-sorting machine.

Aerodynamic shapes designed to travel at over 8,000 miles per hour can be tested in a new wind tunnel.

Layers of steel, bronze and a mixture of lead and plastic compose a new dry bearing material that requires no lubrication.

Coils of aluminum, plastic or steel, up to 82″ O.D., can now be spiral wrapped by machine.

A new method of producing electricity uses a fuel cell that converts hydrogen and oxygen into direct current by means of a catalyst.

A new recording instrument measures heat absorption in any area and is used for allocating air conditioning or heating charges to tenants.

Quartz tubing is being made so small that fifty feet contain only one drop of water.

A new heat resistant paper is made of ceramic fibers.

Simplex Goes To Sea

The 36,000-foot "sea section" of the Simplex submarine communication cable, for use between Cape Neddick, Maine, and Boone Island Light, was loaded in August at Boston.

The cable came off a giant reel (dia. of head 126 inches) and was carried over a capstan to the 126-foot barge.

The cable is described as "4-conductor, No. 9 AWG stranded, ANHYDREX insulated, armored submarine communication cable."

The reel and its load of more than six miles of cable weighed 68 tons.

SIMPLEX WIRE & CABLE CO.
Cambridge, Massachusetts and
Newington, New Hampshire

Simplex

eries

c-
n-
o
a

t
y
ir
es

o
y

s

Sea

" of the
nication
Neddick,
ght, was

reel (dia.
carried
barge.
conduc-
YDREX
e com-

re than
ons.

LE CO.
and
ire

TH
Pu
En
JA

Newest

HONEYWELL MINIATURE RATE GYROS

Rugged enough to withstand 100 G shock

Typical M Series Gyro undergoes 20 G Linear Vibration Test with no deterioration of performance.

Model M-1
shown actual size

Sensitive enough to detect 0.005° per second

Honeywell's newest miniature rate gyros, Type M Series, are rugged enough to withstand repeated shocks and linear accelerations up to 100 G yet sensitive enough to detect turn rates of only 0.005 degrees per second. A damping ratio variation of 2 to 1 or better is maintained without heaters by a unique fluid damped, temperature compensated system that assures reliable operation over the entire operating temperature range.

Type M Series Gyros are specifically designed for autopilot damping, radar antenna stabilization and fire control applications. Their small size, high performance and ruggedness suit them particularly for high performance military aircraft and guided missile applications. Write for Bulletin M to Minneapolis-Honeywell, Boston Division, Dept. 1, 40 Life Street, Boston 35, Mass.

DESCRIPTIVE DATA

FULL SCALE RANGE: to 400 degrees per second

THRESHOLD-RESOLUTION: 0.005 degrees per second

LINEARITY: 0.1 % to 2 % depending on range

DAMPING: 2 to 1 (or better)

TEMPERATURE RANGE: −65 to +200 and +250°F

SHOCK AND ACCELERATION: 100 G

VIBRATION: 20 G to 2000 cps

PICKOFF: Variable Reluctance type providing infinite resolution and high signal-to-noise ratio

MOTOR EXCITATION: 26 volts, 400 cps (standard) 2 phase and 3 phase

SIZE: 1" diameter, 2¾" long

WEIGHT: 4.5 ounces

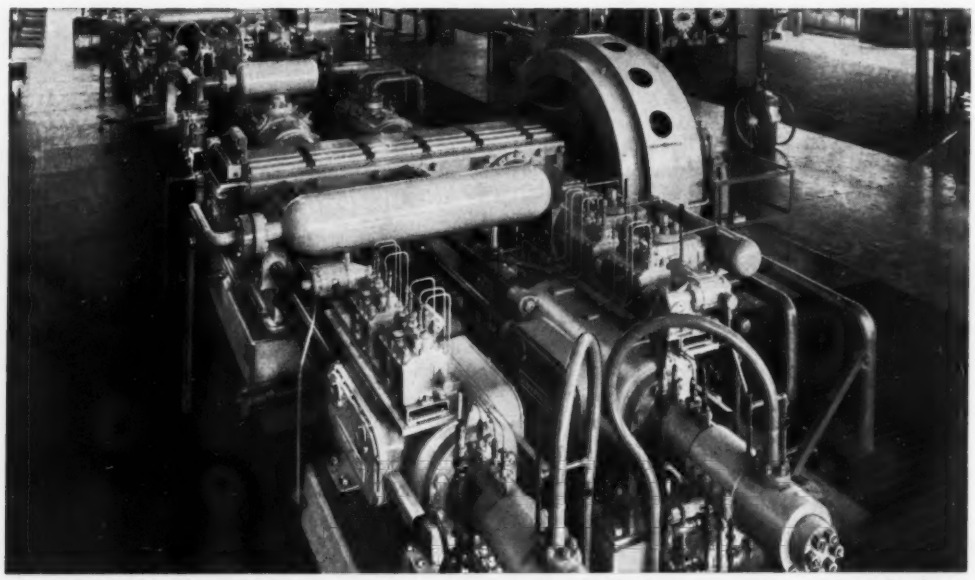
Honeywell

Military Products Group

THE TECHNOLOGY REVIEW, January, 1959, Vol. LXI, No. 3. Published monthly from November to July inclusive at Emmett Street, Bristol, Conn. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription, $4.00: Canadian and Foreign subscription, $4.50. Entered as second-class matter December 23, 1949, at the Post Office, at Bristol, Conn., under the Act of March 3, 1879

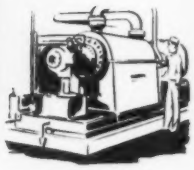
YOUR ENGINEERING CAREER

with INGERSOLL-RAND



Seven electric-driven Ingersoll-Rand reciprocating compressors totaling 21,900 horsepower are at work in this large ammonia synthesis plant. The units in the foreground compress mixed gases to more than 12,000 pounds per square inch.

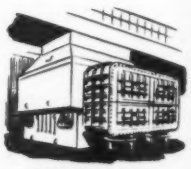
also means LEADERSHIP in



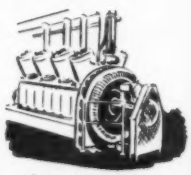
Centrifugal Pumps

Rock Drills

Air & Electric Tools



Steam Condensers



Diesel & Gas Engines

Here's What Compressor Engineering at Ingersoll-Rand can mean to you...

TODAY, air power is one of the industry's most vital requirements. Compressed air and gases are the "breath of life" to chemical and process industries, refineries, power plants, steel mills, manufacturing plants, mines and all types of construction jobs. Hence, compressor and blower engineering offers an exciting and ever-expanding field of challenging opportunities that are virtually industry-wide.

Ingersoll-Rand is the world's largest manufacturer of air and gas compressors and Turbo-Blowers – supplying over 1000 different sizes and types, ranging from ½ hp to 17,250 hp, in pressures from vacuum to 35,000 psi.

Ingersoll-Rand also manufactures pumps, rock drills, diesel and gas engines, vacuum equipment, blowers, air and electric tools and specialized industrial machinery as illustrated at the right. These products require engineering know-how in their design, manufacture and field application.

If you are looking for a leadership career with long-range job security and excellent opportunities for advancement, you'll find it at Ingersoll-Rand. For further details, contact your Placement Office, or write to Ingersoll-Rand, 11 Broadway, New York 4.

OPPORTUNITIES for ENGINEERS NOW AVAILABLE:

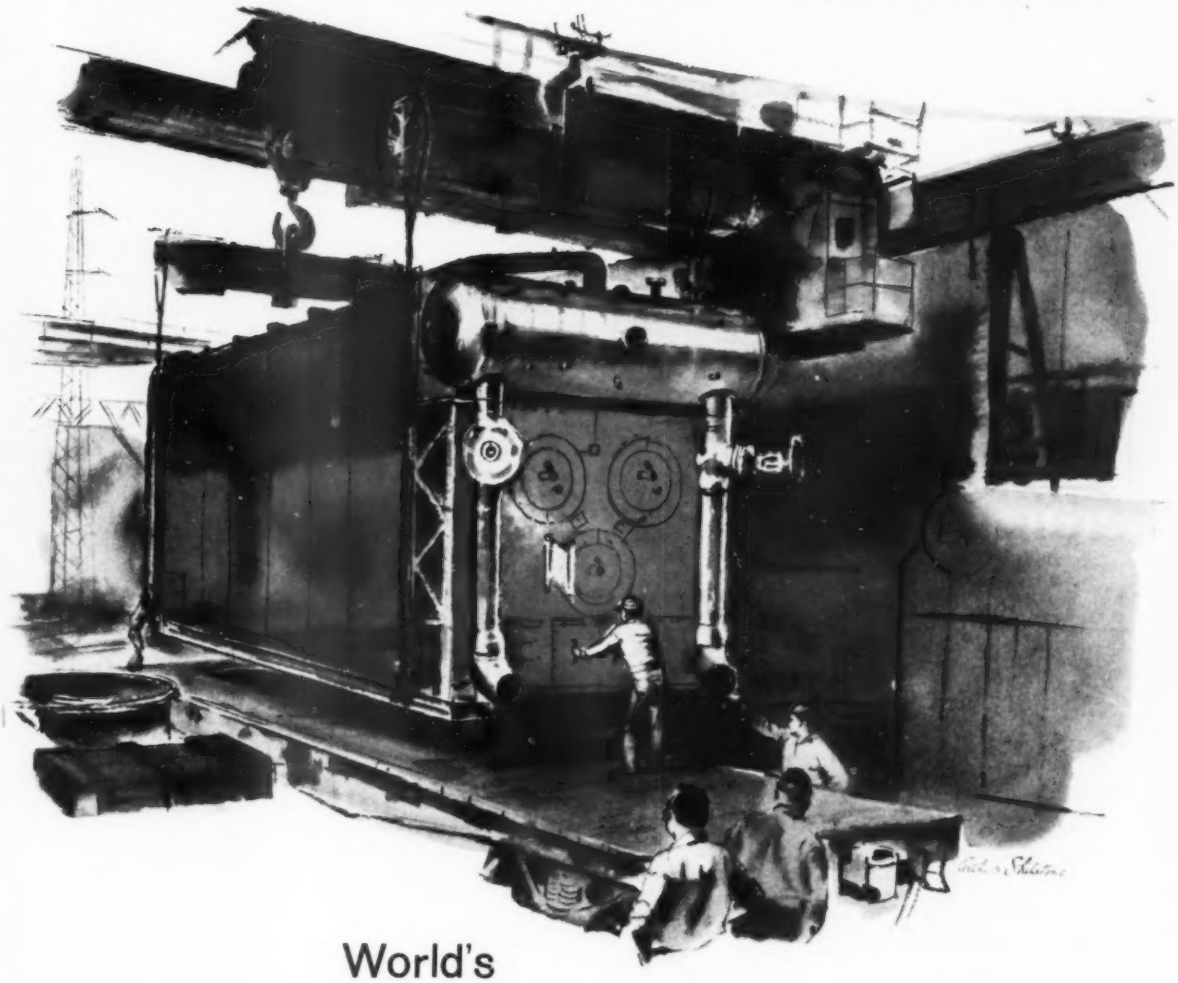
- Sales Engineering
- Design Engineering
- Production Engineering
- Business Engineering

Ingersoll-Rand

1-711 11 Broadway, New York 4, N. Y

Among the many graduates of Massachusetts Institute of Technology at Ingersoll-Rand are: L. C. Hopton, 1926, *First Vice-President and Secretary;* P. J. Bentley, 1925, *Vice-President.*

"CREATIVE ENGINEERING" PROVIDES NEW TYPE OF PACKAGE BOILER TO MEET TODAY'S STEAM NEEDS



World's highest capacity Package Boiler removes traditional space and performance limitations

The flat car pictured above is carrying an engineer's dream. It's a space-saving steam generator which makes electric utility performance standards available to industrial plants. It's a unit of large capacity—yet it's factory-assembled and ready to be installed as a one-piece "package." It's a product which reflects C-E's record of developing steam equipment that introduces new standards of performance.

For the first time, here's a boiler capable of producing over 100,000 pounds of steam every hour . . . and at pressures and temperatures previously unobtainable in a 'packaged' unit. These results are made possible by utilizing *C-E Controlled Circulation*, the most notable development of this decade in the field of large utility boilers.

In short, here's a new alliance of performance with economy. This is what progressive management demands of its capital equipment. This is what you can count on *Combustion* to deliver.

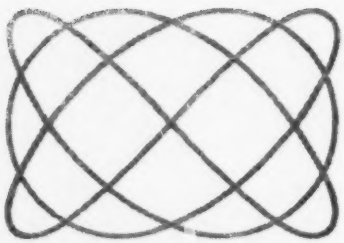
"CREATIVE ENGINEERING" is the reason for the leadership attained by C-E products. The products which bear this mark of leadership include:

all types of steam generating, fuel burning and related equipment · nuclear power systems · paper mill equipment · pulverizers · flash drying systems · pressure vessels · soil pipe

COMBUSTION ENGINEERING

Combustion Engineering Building, 200 Madison Avenue, New York 16, N. Y.

C-187



PHYSICISTS

ENGINEERS

MATHEMATICIANS

are invited to join the Lincoln Laboratory scientists and engineers whose ideas have contributed to new concepts in the field of electronic air defense.

A brochure describing the following Laboratory programs will be forwarded upon request.

HEAVY RADARS
MEMORY DEVICES
TRANSISTORIZED DIGITAL COMPUTERS
SCATTER COMMUNICATIONS
SOLID STATE
AEW (air-borne early warning)
SAGE (semi-automatic ground environment)
SYSTEMS ANALYSIS

In certain of these programs, positions of significant professional scope and responsibility are open to men and women with superior qualifications.

Research and Development

MIT

LINCOLN LABORATORY
BOX 28
LEXINGTON 73, MASSACHUSETTS

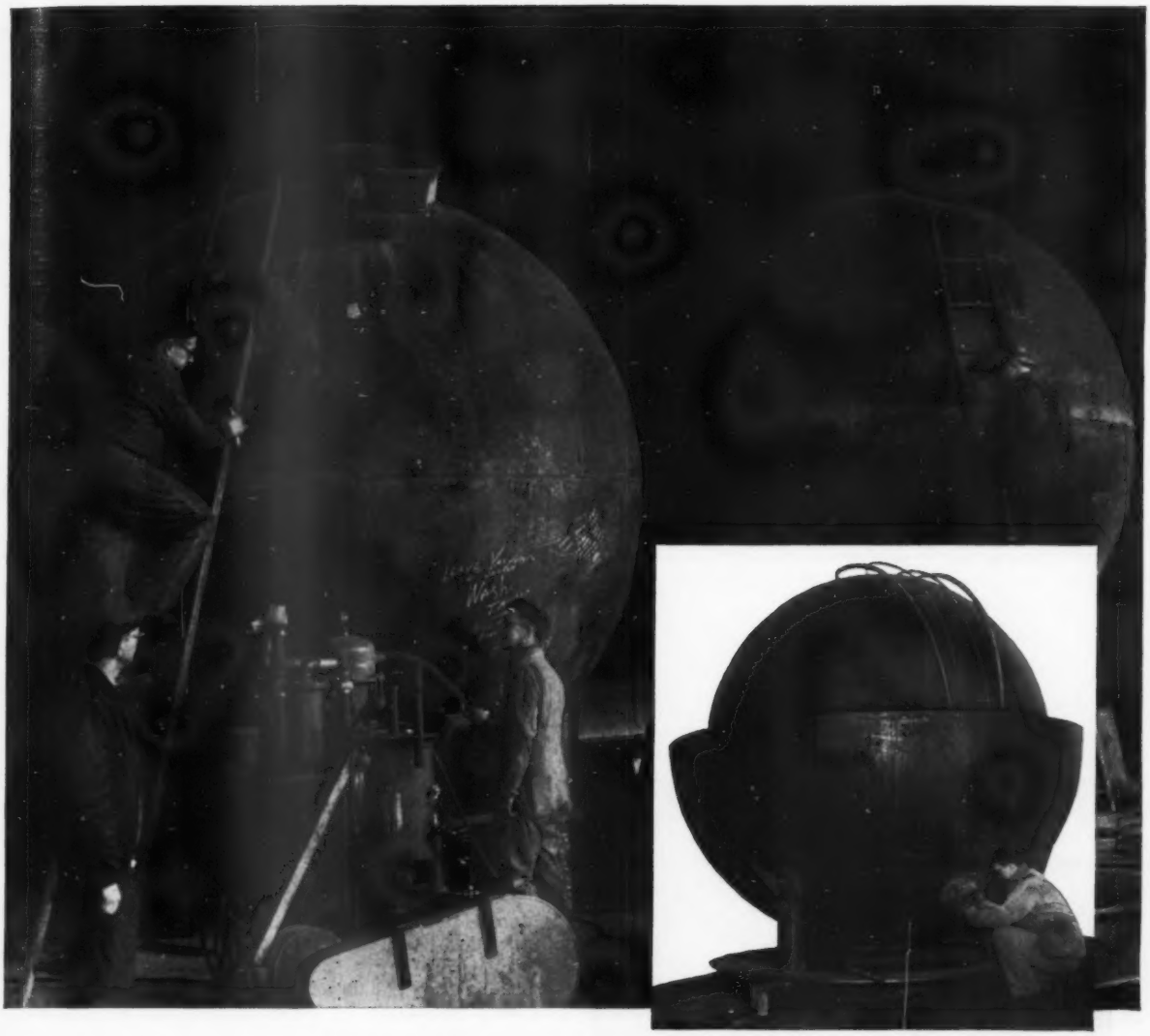
THE TABULAR VIEW

Decade in Review. — Perhaps the term "explosive expansion" best describes the changes that have taken place at M.I.T. since the end of World War II. At any rate, in preparing a survey of events that have transpired at M.I.T. during the 10 years of President Killian's administration, the major editorial difficulty has been to determine which of the many significant events would have to remain unmentioned for lack of time and space. In writing THE TECHNOLOGY REVIEW REPORT in this issue (page 137), the editor wishes to acknowledge helpful cooperation from the Treasurer's Office, the Registrar's Office, the Office of the Dean of the Graduate School, and the Office of Physical Plant, whose personnel made available the statistical data included in this article.

In reviewing the progress at M.I.T. for the past 10 years, we found it interesting to recall some of the more important events that took place elsewhere in the past decade. The North Atlantic Treaty Organization was formed in 1949, and in September of that year President Truman announced that an atomic explosion had occurred in the Soviet Union. During 1950, Jacob Malik of the U.S.S.R. walked out of the United Nations in January; six months later, Korea was invaded. In 1951, General Douglas MacArthur was relieved of his command, and on September 4 transcontinental television service was inaugurated. In November, 1952, General Eisenhower was elected President of the United States. Three significant events occurred in 1953: Joseph Stalin died; the U.S.S.R. announced a test of the hydrogen bomb; and Elizabeth II was crowned queen in Westminster Abbey. The *Nautilus*, first atomic-powered submarine was launched at Groton, Conn., in 1954, and racial segregation in the public schools was declared to be unconstitutional. Albert Einstein died in Princeton, N.J., on April 18, 1955. In 1956 Nikita Khrushchev denounced Stalinism, and the first transatlantic telephone cable was put into operation. On August 10, 1957, the Committee on Education Beyond the High School issued its report, predicting crises in college education. The Russians launched their first artificial satellite on October 4 and their second on November 4. On November 7, President Eisenhower named Dr. Killian to be his Special Assistant for Science and Technology.

Education, with Perspective. — As society becomes ever more complex, the problem of providing training programs, for properly educating a nation's citizens to fulfill their obligations, becomes increasingly difficult. Today, educators in many advanced nations are struggling heroically with this task which probably has no single "best" solution, even within a given country. The debate of the liberal arts versus technical education is giving way to the general recognition that significant elements from both programs are essential for an educated person of today. The importance of history in helping to provide the essential ingredient of perspective (which every successful educational program supplies) is discussed (page 147) by ROBERT S. WOODBURY, '28, Assistant Professor of English and History in the Institute's Department of Humanities. After having been graduated in 1928 from the Institute's Course IX-C, where he studied mathematics and theoretical physics, Professor Woodbury continued studies in mathematics at M.I.T. for another two years. In 1936, Harvard University awarded him the A.M. degree in the history of sci-

(*Concluded on page 122*)



LINDE SELECTED GRAVER
To Build These Liquid Oxygen Storage Spheres

To keep oxygen liquid—at 297° below zero—for prolonged periods, requires quality fabrication of the container. Otherwise, losses from heat-leak, and consequent evaporation, would increase oxygen cost.

To meet these severe requirements in fabrication, Linde Company (Div. of Union Carbide), a leading producer and shipper of liquid oxygen, chose Graver to fabricate these 9 ft. diameter, double-shell spheres. The inner shells are constructed of 304 stainless steel, and the outer jackets of carbon steel. Insulation is by Linde-patented powder-vacuum. Fabricated with air-tight welding to assure holding the vacuum between the shells, the spheres were delivered complete with instruments ready for installation.

The fabricating and welding skills in these liquid oxygen spheres are the result of many years of experience. Graver's extensive background in the field of cryogenics is but one of the many reasons why companies regularly turn to Graver to fabricate storage and processing vessels in alloys and carbon steels—especially those calling for the special skills required for quality production to meet severe operating conditions.

GRAVER®
ALLOY DIVISION

Building for the Future on a Century of Craftsmanship in Steels and Alloys

GRAVER TANK & MFG. CO., INC.
EAST CHICAGO, INDIANA • New York • Philadelphia
Edge Moor, Delaware • Pittsburgh • Atlanta • Detroit • Chicago
Tulsa • Sand Springs, Oklahoma • Houston • New Orleans
Los Angeles • Fontana, California • San Francisco

Instron – the tester that stretches dollars

Testing equipment dollars, that is. Here's how:
in testing metals, plastics, rubber, textiles, wire, adhesives, and many other materials, the Instron Universal Tester stretches equipment dollars simply because it saves money. And it saves money — *and* time — *and* trouble — simply because it *does* more . . . more accurately.
For facts booklet, write:

INSTRON
ENGINEERING CORPORATION
2503 Washington St., Canton, Massachusetts

HAROLD HINDMAN '39 II GEORGE S. BURR '41 VIII

NEW
VIBRATING
CAPACITOR
A vibrating-reed type capacitance modulator for use in measuring currents as low as 10^{-16} amperes.
Long term stability for process control. Drift ±0.2 millivolts per day, non-cum.
Write for Catalog 523.
STEVENS
INCORPORATED
ARNOLD
7 ELKINS STREET
SOUTH BOSTON 27, MASS.

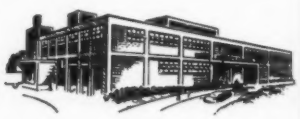
THE TABULAR VIEW

(Concluded from page 120)

ence. Except for seven years as Commander in the Navy during World War II, since 1929 Professor Woodbury has been engaged in teaching intellectual history, history of science, and history of engineering to M.I.T. students.

Fort Washington. – Few of the ever-growing number of M.I.T. students, or members of the Institute's Faculty or staff, are acquainted with the historic gun emplacements erected during the early years of the American Revolution on land that is virtually in the Institute's "back yard." Bostonians, too – whether proper or improper – are equally insouciant concerning this historic spot which bears the name of Fort Washington. The fort (now a small park) is not far from the Tech Boat House; it is located in an industrial section of Cambridge, just across the Boston and Albany tracks from the Westgate housing unit for married M.I.T. students. The history of this fort was recorded several years ago by the late CHARLES W. SHERMAN, '90, who brought it to the attention of The Review's editor. Mr. Sherman's manuscript was held for the obviously propitious occasion of celebrating the centennial of the gift of the park to the City of Cambridge, and appears on page 150 of this issue. Mr. Sherman received the S.B. degree in Civil Engineering from M.I.T. in 1890 and in 1895 received the master's degree in the same field from Cornell University. He was a member of the firm of Metcalf and Eddy for many years, and after his retirement in 1938, served as consultant to his well-known firm. From 1937 until 1954, he was president of the Belmont Savings Bank in Belmont, Mass. After 1954, he became a vice-president of the bank. He was also a director of the Merchants Cooperative Bank of Boston, and a former water commissioner of the Town of Belmont, Mass., where he lived for 58 years. Mr. Sherman was former president of the New England Water Works Association, former vice-president of the Boston Society of Civil Engineers, and a member of many educational, engineering, and historical associations. He died at his home on January 17, 1958. Photographs for Mr. Sherman's article, showing Fort Washington as it appears today, were made by the late Raymond E. Hanson, '03.

McKesson & Robbins, Inc.
Chapman, Evans & Delehanty, Architects

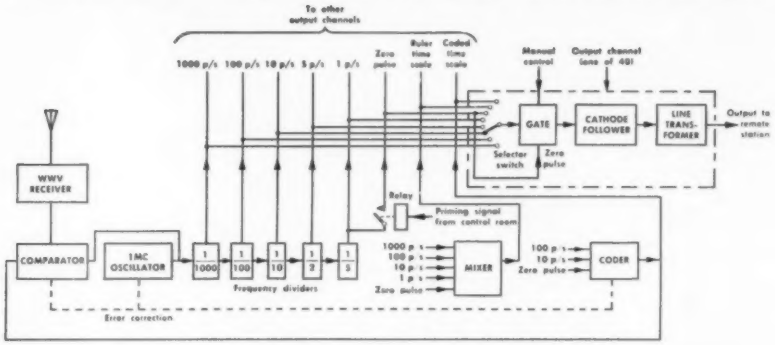


We've been proving it for 42 years

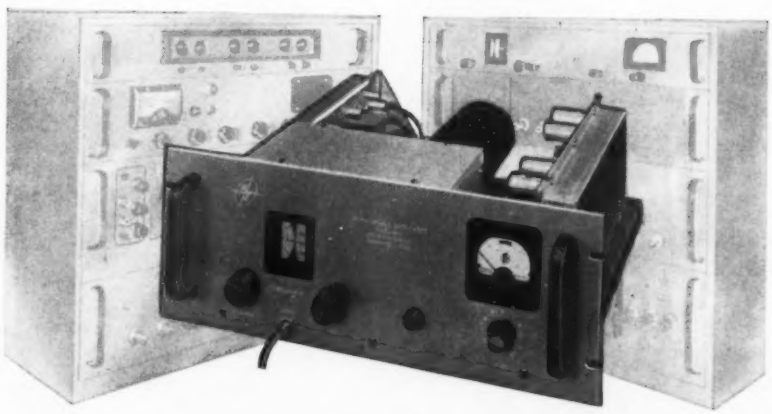
For the past 42 years we have been proving that quality construction can be obtained at reasonable cost. Also that the owner can count on prompt completion. As a result, we have been engaged repeatedly by leading corporations. 70% of our contracts come from those we have served before!

W. J. BARNEY CORPORATION
Founded 1917
INDUSTRIAL CONSTRUCTION
101 Park Avenue, New York
Alfred T. Glassett, '20, President

AN INTEGRATED TIMING SYSTEM FOR TRACKING AND CONTROL OF MISSILES



Schematic diagram of Central Timing Station



The Hycon Eastern Integrated Timing System, when used as a central station timer, meets the requirements of most range instrumentation with one comprehensive unit. At pre-programed times during the shoot, time markers are supplied to recording instruments and switching pulses are supplied to recording and control instruments located in remote slave stations.

At the heart of the Timing System is the Hycon Eastern Ultra Stable Oscillator with guaranteed stability of one part in 10^9 and even greater stability in actual practice. A WWV Receiver corrects for drift error of the time base oscillator over long time periods and a time scale is available with resolutions accurate to 1 microsecond

Solar or sidereal time is displayed visually and is available for both input to automatic computers and as an index to data being recorded during the test run. Capable of operating anywhere in the world, this system is also suited for astronomical measurements and navigation systems Write for Bulletin TS-00.

Tomorrow's Timing Systems . . . Today

HYCON EASTERN, INC.

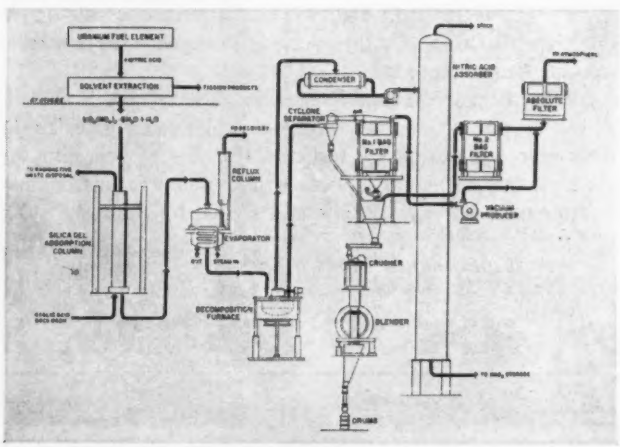
75 Cambridge Parkway Dept H Cambridge 42, Mass.

LUMMUS DESIGNS, ENGINEERS, CONSTRUCTS FOR THE NUCLEAR INDUSTRY

Heavy Water Area, Savannah River Plant. Lummus handled design, engineering, procurement and construction liaison of this area.

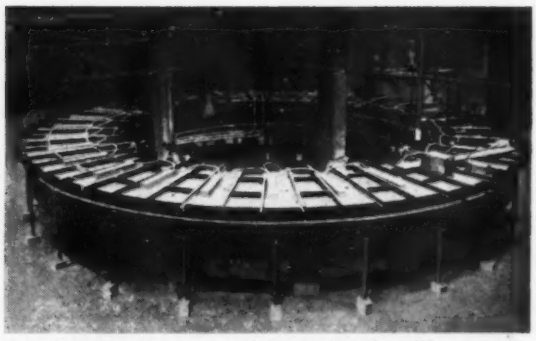
World-wide designers, engineers and constructors of over 800 major plants for the process industries in the last half century, Lummus now offers its experience for the development of atomic energy installations. Here are some current examples of Lummus work in this field:

Uranium Oxide Recovery Unit of the Savannah River Plant. Lummus handled design, engineering, procurement and construction liaison of this unit.



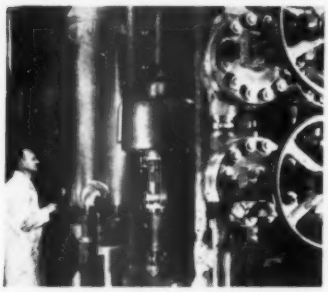
Nitric Acid Recovery Uni of the Savannah River Plan Chemical Separations Plant Lummus handled design, en gineering, procurement an construction liaison of th unit.

Plant engineered and designed by Lummus for Beryllium Corporation to extract beryllium metal from beryl ore.



Ore sintering furnace used to produce beryllium metal.

Below is the high pressure, high temperature test facility, constructed by Lummus at its Engineering Development Center for the Knolls Atomic Power Laboratory. The facility consists essentially of a pressurized water heat exchange system and demineralizing equipment. Reactor fuel and materials samples are inserted in the in-pile test section for study under controlled conditions of temperatures, pressure, radiation flux, and water conditions.

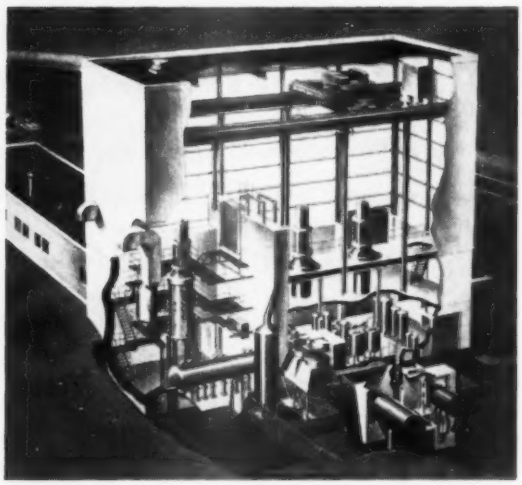


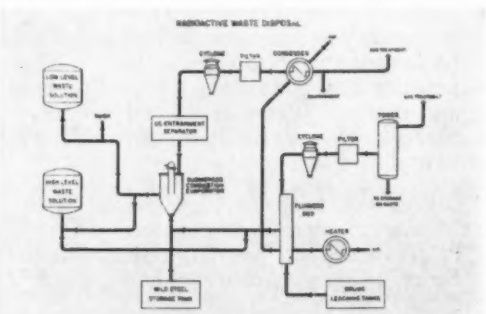
Pressurizer, main flow control valve, loop block valves.

Test Loop Control Panel.

Four loop pump volutes with special cover plates for hydrostatic testing.

This high temperature test facility was designed and engineered by The Lummus Company under sub-contract to Westinghouse Electric Corporation, Bettis Atomic Power Division. Its purpose is to make criticality measurements and to determine flux distributions in water moderated reactors operating at low power levels and elevated temperatures and pressures.





In the not too distant future, large volumes of radio-active wastes will be forthcoming from power reactor operations. Great quantities of this material are now being stored in costly underground tankage. We believe that it would further reactor development to have a more economical and safe waste disposal system to take care of the large radio-active waste volumes. The Lummus approach to this has been directed toward utilizing known engineering techniques which require special consideration due to the unique problems associated with radio-active waste.

Lummus' extensive experience in evaporation, entrainment, condensation, fluidization, material handling and other unit operations, is available to design and engineer radio-active waste disposal systems of the type shown here.

Visit the Lummus Exhibit, Fifth World Petroleum Congress Exposition,
New York Coliseum, June 1-5, 1959

LUMMUS

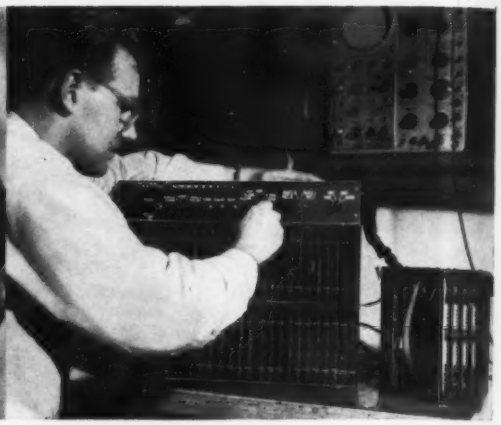
ENGINEERS AND CONSTRUCTORS FOR INDUSTRY THROUGHOUT THE WORLD

385 MADISON AVENUE, NEW YORK 17, N.Y.

WASHINGTON, D. C. • HOUSTON • MONTREAL • MARACAIBO • LONDON • PARIS • THE HAGUE

WHY do so many engineers choose Sperry?

Convair's B-58 Hustler with Sperry inertial navigation system will be able to navigate undetected for thousands of miles to exact target.



Engineer tests new airborne digital computer designed by Sperry.

4 reasons . . .

Important assignments . . . As in the field of Advanced inertial guidance. Complete systems or components for aircraft, missiles and spacecraft. To design and produce extremely accurate inertial guidance systems requires a complex combination of engineering and manufacturing skills. The long background in gyroscopics, electronics and computation has made it possible for Sperry to design and produce advanced inertial systems . . . other Sperry inertial systems will, one day, allow man to explore space.

Diversified projects . . . connected with Polaris Missile . . . integrated countermeasures systems . . . Tactical early warning radar systems . . . new Sperry radar guidance system—are only a few of the widely diversified kinds of projects Sperry Engineers are assigned to.

Engineering "climate" . . . You will work alongside of, and with, nationally famous engineers . . . for a firm in which most of the top men are engineers who have worked their way up . . . a firm of engineers, run *by* engineers.

Career opportunities . . . Sperry Gyroscope stands for steady growth. For almost a half century, we've been expanding—and our engineers have grown with us. We offer something more than a job, to the right man. We offer a career, and a rewarding future.

If these reasons make sound sense to you, check Sperry.

Openings in Many Specializations Including:

RADAR RECEIVERS
INFRARED SYSTEMS
RADAR TRANSMITTERS
PULSE CIRCUITS
INERTIAL NAVIGATION SYSTEMS
TEST EQUIPMENT DESIGN
FLIGHT TEST ENGINEERING
BROAD BAND ANTENNAS
TRANSISTOR CIRCUITS
For Pulse & Video Applications
MICROWAVE ANTENNA DESIGN
ELECTRONIC COUNTERMEASURES

Confidential Interviews

Contact Mr. J. W. Dwyer, Employment Manager
Saturday AM Interviews Arranged by appointment

SPERRY
GYROSCOPE COMPANY
Division of Sperry Rand Corp.
Great Neck, Long Island, N. Y., Fieldstone 7-3665

. . . pipes or purses

. . . cleats or clay pigeons

. . . galoshes or golf balls

Better Products begin with CABOT!

Whether they're smoked, shot at, or whacked with a 2-iron, products containing Cabot raw materials contain a precious plus.

The plus comes from 75 years of Cabot know-how... three quarters of a century spent in intimate association with industry, its markets, and its problems. From this rich storehouse of experience... from the wide variety of Cabot raw materials . . . may come the product plus you've been looking for.

Whatever you make, it costs nothing to find out if Cabot can put a plus in your product. Why not put a call in . . . today?

WHICH OF THESE CABOT MATERIALS CAN HELP YOUR PRODUCT?

CABOT CARBON BLACKS . . . *more than 45 different grades of channel, furnace and thermal blacks for use by the rubber, printing ink, paint, varnish, lacquer, enamel, plastics, paper, phonograph record, battery and other industries.*

WOLLASTONITE . . . *as a paint pigment, this white, uniform calcium metasilicate, has more desirable properties than other extenders used singly or in combination. Excellent for ALL types of paint, and for the quality improvement of wall tile and semi-vitreous ceramics.*

CAB-O-SIL® . . . *this unique colloidal silica, in extremely small quantities, greatly improves large numbers of products. The best flow control agent available, it's especially remarkable for its unusual combination of properties. Used for rubber, paint, varnish, printing ink, plastics, lubricants, cosmetics, many other products.*

PT® PINE TAR PRODUCTS . . . *these versatile quality controlled materials improve the performance of a wide variety of products, including: rubber, paint, cordage, oakum and insecticides.*

For complete information, phone or write:

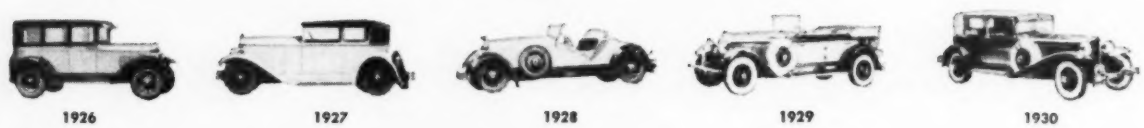
GODFREY L. CABOT, INC.
77 FRANKLIN ST., BOSTON 10, MASSACHUSETTS
Phone: Liberty 2-7300

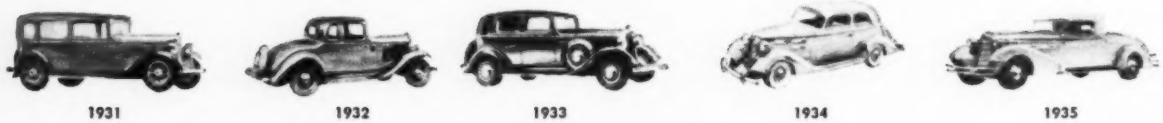
CABOT

Again . . . one of the most remarkable votes of public confidence in the history of American industry

1915 1916 1917 1918 1919 1920

1921 1922 1923 1924 1925


1926 1927 1928 1929 1930


1931 1932 1933 1934 1935

1936 1937 1938 1939 1940 1941

1942 1943 1944 1945 1946 1947

1948 1949 1950 1951 1952 1953

1954 1955 1956 1957 1958

Again in 1959 . . . as in every single year for 44 consecutive years . . .

MORE PEOPLE RIDE ON GOODYEAR TIRES THAN ON ANY OTHER KIND

GOODYEAR TIRES

GOODYEAR

Watch "Goodyear Theater" on TV every other Monday evening

THE TECHNOLOGY REVIEW

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

CONTENTS for JANUARY, 1959, Vol. 61, No. 3

JULIUS ADAMS STRATTON, 11th PRESIDENT OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY — Front Cover
Photograph by M.I.T. Photographic Service

CORPORATION CHAIRMEN — Frontispiece 130
Photographs by Fabian Bachrach and M.I.T. Photographic Service

DECADE IN REVIEW — A Technology Review Report 137
If you haven't been back at the Institute in the past 10 years, you probably won't know the place, for its growth and expansion in all fields of endeavor have been almost explosive

SCIENCE, ENGINEERING, AND THE HUMANITIES — By Robert S. Woodbury 147
How can our educational process be evolved to form a consistent whole, with the educated person separated from the technician by understanding what he knows?

FORT WASHINGTON — By Charles W. Sherman 150
Historic fortification, built during the American Revolution, is little known to M.I.T. students, or to Bostonians, generally, although bordering on M.I.T. property

THE TABULAR VIEW — 120
Contributors and contributions to this issue

THE TREND OF AFFAIRS — 131
Relating to the Massachusetts Institute of Technology

Professor Theos J. Thompson at control panel of the M.I.T. Nuclear Reactor, latest major research unit to be put into service at the Institute.

M.I.T. Photo

EDITOR:
B. Dudley
BUSINESS MANAGER:
R. T. Jope
CIRCULATION MANAGER:
D. P. Severance
EDITORIAL ASSOCIATES:
Paul Cohen
J. R. Killian, Jr.
F. W. Nordsiek
J. J. Rowlands
EDITORIAL STAFF:
Ruth King
Shirley G. Reese
Winifred R. Sibley
BUSINESS STAFF:
Madeline R. McCormick
PUBLISHER:
H. E. Lobdell

Published monthly from November to July inclusive on the twenty-seventh of the month preceding the date of issue, at 60 cents a copy. Annual subscription, $4.00; Canadian and foreign subscription, $4.50. Published for the Alumni Association of the M.I.T.; John J. Wilson, President; H. E. Lobdell, Executive Vice-president; D. Reid Weedon, Jr., William W. Garth, Jr., Vice-presidents; Donald P. Severance, Secretary-Treasurer. Published at Hildreth Press., Inc., Bristol, Conn. Editorial Office, Room 1-281, Massachusetts Institute of Technology, Cambridge 39, Mass. Entered as second-class mail matter at the Post Office at Bristol, Conn. Copyrighted, 1959, by the Alumni Association of the Massachusetts Institute of Technology. Three weeks must be allowed to effect change of address, for which both old and new addresses should be given.

Corporation Chairmen

Fabian Bachrach

James R. Killian, Jr., '26

■ After having served the Institute as its President since October 4, 1948, James R. Killian, Jr., '26, becomes Chairman of the M.I.T. Corporation. Because of his continuing leave status and his full-time occupation in Washington as Special Assistant for Science and Technology to the President of the United States, Dr. Killian expressed the wish, last October, that he be relieved of the presidency of the Institute whenever a successor could be appointed.

In naming Dr. Killian to the post of Chairman, the M.I.T. Corporation expressed its strong conviction that the Institute now has indispensable need for two full-time senior officers – the Chairman of the Corporation and the President as Chief Executive Officer. It also urged that when Dr. Killian completes his present assignment in Washington he return to the Institute as full-time Chairman of the Corporation, a post that would enable him to concentrate on those aspects of the Institute's program that look outward rather than inward and that would be concerned with over-all trustee policy, sharing with President Stratton the formulation of Institute goals.

As its 10th President, Dr. Killian is the first Technology graduate to hold this high post. Great expansion has marked M.I.T. activities during his administration, as is recorded in this issue (page 137) under the title "Decade in Review."

M.I.T. Photo

Vannevar Bush, '16

■ Since his election to the post on March 22, 1957, Vannevar Bush, '16, has been Chairman of the M.I.T. Corporation, of which he was already a life member. At the meeting of the M.I.T. Corporation on December 1, 1958, Dr. Bush was elected to the new post of Honorary Chairman. This action is a particularly happy one, for it leaves Dr. Bush free to devote his energies and interests to a wide range of activities; it makes available to President Stratton and Dr. Killian, the wisdom and experience of Dr. Bush.

Dr. Bush joined the staff of the Institute's Department of Electrical Engineering in 1919. His brilliant application of advanced mathematical methods to electrical engineering and the development of the differential analyzer assured his rapid promotion on the Faculty. He was Dean of Engineering and Vice-president of M.I.T. from 1932 until the end of 1938, when he became President of the Carnegie Institution of Washington. During and after World War II he made unprecedented contributions to the application of science and technology in maintaining the nation's freedom. He was chairman of the National Defense Research Committee, 1940–1941; director of the Office of Scientific Research and Development, 1941–1946; and chairman of the Research and Development Board, National Military Establishment, 1947–1948.

The Technology Review

VOL. 61, NO. 3 JANUARY, 1959

The Trend of Affairs

Presidential Succession

■ Julius Adams Stratton, '23, whose portrait appears on the cover of this issue of The Review, became the 11th President of the Institute on January 1, 1959. As the second M.I.T. Alumnus to hold this high post, Dr. Stratton follows in the footsteps of James R. Killian, Jr., '26, whom he succeeds. Dr. Killian has been named chairman of the Corporation, and Vannevar Bush, '16, became honorary chairman of the Corporation. These administrative changes were voted by the M.I.T. Corporation at its regular meeting on December 1. Early report of this action of the Corporation was made to Review readers by a special announcement bound in the December issue, as page 64A, but it is now The Review's pleasure to record this momentous event in somewhat greater detail.

At a specially convened Faculty gathering, held immediately following the meeting of the M.I.T. Corporation, Dr. Bush announced election of the new officers to members of the M.I.T. family. As chairman of this special Faculty meeting, Dr. Bush said, in part:

"It is with great pleasure I announce that the M.I.T. Corporation at its meeting today confirmed the appointment of Dr. Julius A. Stratton, now Chancellor and Acting President, as the next President and Chief Executive Officer of the Massachusetts Institute of Technology, effective January 1, 1959.

"With equal satisfaction, I also report that the Corporation has accepted my resignation as Chairman and has elected Dr. James R. Killian, Jr., to this post. Dr. Killian will continue on leave of absence from the Institute in order to serve as Special Assistant to the President of the United States for Science and Technology. We all hope that he will be able to return to the Institute in the near future; and when he does, he will assume the responsibilities of his new post as full-time Chairman of the Corporation. . . .

"In making the new appointments, the Corporation has recognized the indispensable need for two full-time officers, the Chairman of the Corporation, and the President as Chief Executive Officer."

Dr. Stratton became acting president of the Institute in November, 1957, when President Killian was named to his present Washington post by President Eisenhower. As chancellor, Dr. Stratton was already in full charge of the Institute's academic program and, in fact, general executive officer for all Institute affairs.

Since 1949, when he was appointed provost, Dr. Stratton has been a principal administrative officer of M.I.T. He became vice-president and a member of the Corporation in 1951 and was appointed chancellor in 1956, becoming a member of the Executive Committee of the Corporation at the same time.

Dr. Stratton has had a wide variety of experience in academic responsibilities and his scientific interests have been very broad. He has degrees in both physics and electrical engineering and was one of the early students in the field which has come to be known as electronics. He has written numerous technical papers on electrical theory.

Dr. Stratton was born on May 18, 1901, in Seattle, Wash., the son of Julius A. and Laura (Adams) Stratton. After one year at the University of Washington he attended M.I.T. where he received the degree of bachelor of science in Electrical Engineering in 1923. He then spent a year at the Universities of Grenoble and Toulouse, and returned to M.I.T. as a research associate in electrical communications, receiving his master of science degree in 1926. He was awarded the degree of doctor of science in mathematical physics from the Eidgenossische Technische Hochschule of Zurich in 1927, and remained in Europe on a traveling fellowship from M.I.T., studying principally at the Universities of Munich and Leipzig. Dr. Stratton was appointed assistant professor of electrical engineering at M.I.T. in 1928. In 1930 he transferred to the Department of Physics and became professor of physics in 1941.

He was one of the first members of the staff of the Radiation Laboratory, established by M.I.T. 14 months before Pearl Harbor to develop radar. In 1942 he was detached from the Laboratory to become Expert Consultant in the Office of the Secretary of War. During this period he organized a series of technical advisory committees to the Air Forces on programs of ground radar, radar fire control, and radar bombing. For these services he received the Medal for Merit from the Secretary of War in 1946.

He received a Certificate of Award from the Secretary of Navy in July, 1957, in appreciation of distinguished public service.

Following the termination of the Radiation Laboratory after the war, Dr. Stratton established the Research Laboratory of Electronics at M.I.T., and acted as director until he was appointed provost.

He is currently a fellow of the National Academy of Science and a member and a former chairman of the Naval Research Advisory Committee. He is a trustee and member of the Executive Committee of the Boston Museum of Fine Arts; a trustee and member of the Executive Committee of the Ford Foundation; a member-trustee of the Rand Corporation (a nonprofit organization engaged in research for the U.S. Air Force and other government agencies); a member of the National Science Board and of the Corporation of the Woods Hole Oceanographic Institution; a fellow of the American Academy of Arts and Sciences, the American Philosophical Society, the American Physical Society, and the American Institute of Radio Engineers, which awarded him its Medal of Honor for 1957. He is a member of Zeta Psi, Tau Beta Pi, Sigma Xi, and the St. Botolph Club.

Dr. Stratton is the author of a treatise on "Electromagnetic Theory" and various other technical papers. He married Catherine N. Coffman of Charlottesville, Va., in 1935. They have three daughters – Catherine N., Ann Cary, and Laura Adams.

Our heartiest congratulations go out to Dr. Stratton in his new and well-deserved honor. A brilliant scholar, outstanding administrator, mathematical physicist, dedicated teacher, meticulous author, and loyal Alumnus, Dr. Stratton has our best wishes, whole-hearted co-operation, and sympathetic understanding as he assumes additional heavy responsibilities in becoming the 11th President of the Massachusetts Institute of Technology.

Scholarship Awards

■ At a dinner meeting held in the Faculty Club on Tuesday, November 25, approximately 150 members and friends of the Boston Stein Club joined with members of the Institute's Administration for the presentation of the Club's Freshman Scholarship Fund. The presentation, in the amount of $58,000, was made by Fund Chairman Oscar H. Horovitz, '22, to J. A. Stratton, '23, then Acting President of the Institute. Income from the fund is to be used for freshman scholarships.

Melvin W. Friedman, '46, President of the Stein Club, was master of ceremonies and introduced Mr. Horovitz, as well as Dr. Stratton who made the acceptance address. In accepting this fund, Dr. Stratton emphasized (as had Karl T. Compton, five years earlier) the importance of scholarship funds for Technology students.

Honored guests at the head table included: H. E. Lobdell, '17, Executive Vice-president of the Alumni Association, who brought the Association's greetings to the club; Mrs. Karl T. Compton, wife of former M.I.T. President Compton; Horace S. Ford, Treasurer Emeritus; and Joseph J. Snyder, '44, M.I.T. Treasurer and Vice-president; as well as Boston Stein Club officers, Messrs. Friedman and Horovitz.

In making the presentation, Mr. Horovitz said: "Since most of our members reside in New England, it was decided to limit our fund to students resident in New England. However, a few of our members . . . live in New York and New Jersey . . . so that their gifts, in the amount of approximately $10,000, do not have the New England residence restriction. In making grants from the income of our fund, there will be no restrictions as to sex, religion, race, or color."

Three members of the Institute's staff were honored in this presentation when Mr. Horovitz remarked:

"In their student days, many of our members were often financially embarrassed and in need of advice and assistance. Mr. Horace Ford, Mr. Delbert Rhind, and Mr. Harold Lobdell will always be remembered by many of our members for their sympathetic answers to these boys who now honor them by special funds within the Stein Club named in their honor."

The scholarship fund is the second major contribution to the Institute's educational program by the Boston Stein Club. The first was the gift of the Map Room in the Hayden Memorial Library.

Principals in the Freshman Scholarship Fund presentation held at the Faculty Club on November 25 were (left to right): Mrs. Karl T. Compton, whose husband's interest in freshman aid initiated the club's program; J. A. Stratton, '23, Acting President, who accepted the check on behalf of the Institute; Melvin W. Friedman, '46, President of the Boston Stein Club; and Oscar H. Horovitz, '22, former President of the club. *M.I.T. Photo*

Individuals Noteworthy

■ Year-end news included the 20 promotions, elections, or appointments which follow:

Leo I. Dana, '17, as Vice-president – Technology, Linde Company Division, Union Carbide Corporation . . . *Raymond Stevens, '17,* as a member of the Corporation, Northeastern University . . . *Carleton W. Blanchard, '18,* as a Director, Acme Wire Company, New Haven, Conn.;

Philip M. Dinkins, '18, as President, General Aniline and Film Corporation . . . *B. Alden Thresher, '20,* as Chairman, College Entrance Examination Board . . . *David A. Shepard, '26,* as a Trustee, New York Public Library;

Joseph S. Harris, '27, as Chairman of the Aviation Advisory Committee, American Petroleum Institute . . . *James R. Rae, '28,* as Chief Engineer, Long Lines Department, American Telephone and Telegraph Company . . . *Gustav A. K. Stachelhaus, '28,* as Manufacturing Manager, Special Tube Operations, Sylvania Electric Products, Inc., Mountain View, Calif.;

Charles M. Perkins, '29, as Chief Engineer, Fuller Manufacturing Company, Kalamazoo, Mich. . . . *Donald B. Sinclair, '31,* as Vice-president, Institute of Radio Engineers . . . *Manson Benedict, '32,* as a member of the General Advisory Committee, Atomic Energy Commission;

Selden B. Spangler, '32, as Director of Research, Garrett Corporation, Phoenix, Ariz. . . . *Albert O. Wilson, Jr., '38,* as a Director, American Leprosy Missions, Inc. . . . *Roy C. Heacock, '39,* as General Manager, Cryogenics Division, Standard Steel Corporation, Los Angeles;

William K. Hooper, '41, as Vice-president, Republic Foil and Metal Mills, Inc., Danbury, Conn. . . . *Franklin K. Pittman, '41,* and *Allen J. Vander Weyden, Jr., '44,* respectively, as Director and Deputy Director, Division of Reactor Development, Atomic Energy Commission . . . *George J. Schwartz, '42,* as a Director, Associated Industries of Massachusetts . . . *Alden A. West, '44,* as a Director, Air Force Association.

■ Special honors coming recently to Alumni and members of the Institute's Faculty included:

To *Welles Bosworth, '89,* a decoration as *Commandeur dans L'ordre des Beaux Arts et des Lettres* for his long-time aid in the restorations of the palace and gardens of Versailles and Trianon, and at Fontainebleu and the Cathedral of Rheims, by the French Minister of Public Education and the Fine Arts;

To *E. Sherman Chase, '06,* honorary membership, by the Federation of Sewage and Industrial Wastes Associations . . . to *J. Newell Stephenson, '09,* the Silver Acorn, second highest award in Scouting, by the Governor-General of Canada;

To *Earle O. Turner, '14,* honorary membership, by the Engineering Institute of Canada . . . to *E. P. Brooks, '17,* an honorary doctorate of science in commerce, by Drexel Institute of Technology;

To *William H. McAdams, '17,* its Gold Medal established "to recognize the most distinguished achievements in the utilization of fuels and thermal energy," by the French Institute for Fuels and Energy . . . to *C. Richard Soderberg, '20,* the Royal Order of the North Star, by the King of Sweden;

To *Martin J. Buerger, '24,* the Roebling Medal, by the Mineralogical Society of America; and a doctorate *honoris causa,* by the University of Berne, Switzerland . . . to *Charles S. Draper, '26,* the grade of Fellow, by the American Rocket Society;

To *James R. Killian, Jr., '26,* its Award of Merit, by the American Institute of Consulting Engineers; an honorary doctorate of science, by Oberlin College; and a Gold Medal for distinguished service to humanity, by the National Institute of Social Sciences . . . to *Thomas A. Fearnside, '31,* the grade of Fellow, by the American Society of Mechanical Engineers;

On the Horizon

January 31, 1959 – 14th M.I.T. Alumni Regional Conference, Detroit, Mich. M.I.T. speakers: Julius A. Stratton, '23, President; George R. Harrison, Dean of the School of Science; John E. Burchard, '23, Dean of the School of Humanities and Social Studies; H. Guyford Stever, Associate Dean of the School of Engineering; Carl F. J. Overhage, Director of M.I.T.'s Lincoln Laboratory; Theos J. Thompson, Director of M.I.T.'s Nuclear Reactor. (For reservations, consult Thomas F. Morrow, '35, Chrysler Corporation, 341 Massachusetts Avenue, Detroit 31, Mich.)

March 12–14, 1959 – 11th Annual Fiesta, M.I.T. Club of Mexico, Mexico City, D.F. (For reservations, consult Clarence M. Cornish, '24, Margaritas 257, Villa Obregon, Mexico 20, D.F., Mexico.)

To *Colonel Leo A. Kiley, Jr., '39,* the Legion of Merit, by the United States Air Force . . . to *W. Kenneth Davis, '40,* its Professional Progress Award, by the American Institute of Chemical Engineers;

To *George J. Yevick, '42,* the honorary degree of Master of Engineering, by Stevens Institute of Technology . . . to *Martin Wohl, '53,* the 1958 Past President's Award, by the Institute of Traffic Engineers;

To *Richard D. Thornton, '54,* the 1959 W. R. G. Baker Award, by the Institute of Radio Engineers . . . to *Arthur C. Cope,* Professor of Organic Chemistry, the Charles Frederick Chandler Medal for achievement in pure or applied science, by Columbia University.

Included in the 76 leading radio engineers and scientists named for 1959 as Fellows of the Institute of Radio Engineers were the following eight Alumni: *Alfred J. Pote, '26; Frank Massa, '27; Peter Elias, '44; J. Ross Macdonald, '44; Samuel J. Mason, '47; John G. Truxal, '47; Malcom W. P. Strandberg, '48; and Benjamin J. Dasher, '52.*

Courtesy of Boston Globe, Gil Friedberg, Staff Photographer

At the soccer game on October 15, Joseph R. Skenderian, '61 (left), and Harvard's Prince Karim, the Aga Khan IV, add excitement. In the final minutes, the Prince kicked a winning (4-3) goal for Harvard. Drafted as varsity goalie in his first soccer game, Skenderian has an enviable record with a total of 100 "saves" in three games this season.

Proctor Portrait Presented

■ An oil painting of Bernard E. Proctor, '23, Head of the Department of Food Technology, was presented to the Institute as a gift from more than 100 of his former students and classmates during brief ceremonies held in the Department's headquarters in the Dorrance Laboratory on Sunday afternoon, November 23.

The painting, by Jacob Binder, well-known Boston artist, was presented by Earle A. Griswold, and was accepted by J. A. Stratton, Acting President. Dr. Stratton, Dr. Proctor and Mr. Griswold are all members of the Class of 1923 at M.I.T., and the latter two were also classmates in Malden High School. Dr. Proctor, who has headed the Department of Food Technology since 1952, and has been a member of the Faculty for more than 30 years, sat for the portrait last summer.

The proposal for the gift was made by former students in biology and food technology, following the 1956 award to Dr. Proctor of the Nicolas Appert Medal for the year's most outstanding and distinguished contribution to the food industry. The award was made by the Institute of Food Technologists, an international professional society of food science and technology.

Following the official acceptance of the portrait by Dr. Stratton, Mrs. Proctor, who was in attendance, was presented a half-size copy of her husband's portrait, also done by the artist, in a surprise ceremony.

The portrait of the M.I.T. professor, who is an international authority on foods, will hang on the second floor of the John T. Dorrance Building, center of the Institute's studies of food technology and biology.

M.I.T. Photo

Earle A. Griswold (left) presents to J. A. Stratton, Acting President, the oil painting of Bernard E. Proctor, who has been head of the Institute's Department of Food Technology since 1952. All principals in this illustration are members of the Class of 1923. Artist of the portrait is the well-known Jacob Binder of Boston. The gift of the painting was made possible by Professor Proctor's former students, and the presentation ceremony was held on November 23.

Student Finances and Occupational Health

■ John J. Wilson, '29, President of the Alumni Association for the current year, opened the highly successful dinner meeting of the Alumni Council which was held on November 24 at the M.I.T. Faculty Club. An unusual – even unique – feature of this 334th meeting was that, for the first time in the records of the Council, its members had the pleasure of listening to a woman as one of its guest speakers. She was Dr. Harriet L. Hardy, Assistant Medical Director in charge of Occupational Medical Service. The other speaker of the evening was Thomas P. Pitré, Director of Student Aid at the Institute.

As a regular item of business to be disposed of before the two major addresses, Donald P. Severance, '38, gave the Secretary-Treasurer's report, in which it was announced that: (1) changes in class affiliation had been made for five Alumni; (2) between May 26 and November 20, 1958, there were 28 members of the Alumni Association or members of the Institute's Faculty and administrative staff who visited 25 M.I.T. clubs in the United States and foreign cities, including Tokyo, San Juan, and Montreal; (3) the Executive Committee had voted to drop from its files, as associate members, all but 85 students who attended M.I.T. for war-training purposes but were never enrolled as regular students; these 85 are those who have contributed at one time or another to the Alumni Fund and for whom addresses are known.

Alf K. Berle, '27, member of the Alumni Fund Board, reported that 5,500 Alumni had contributed $161,000 to the Fund as of November 24. These figures are 20 per cent higher in number of contributors and 33 per cent greater in amount than at the corresponding period a year ago.

In speaking on Financial Aid to Students, Dean Pitré reviewed operations in this field since 1951 when he was appointed director of student aid. His office has been established to co-ordinate financial assistance given to students in the form of scholarships, loans, and employment during the school year. Co-ordinated aid to students has become necessary now that the cost of undergraduate education at the Institute is approximately $11,000 to $12,000.

Educational institutions across the nation have formed the College Scholarship Service (of which M.I.T. is a member) to collect, standardize, and analyze financial information from families of students, so all participating colleges are able to offer essentially the same degree of monetary assistance to a particular student. This practice has encouraged self-regulation and reduced competition among participating educational institutions.

Dean Pitré presented statistics to show the growth of scholarships, loans, and student earnings from 1952 to the present time. During this period, the number of scholarships has increased from 636 to 976; scholarships awarded in 1952-1953 amounted to $266,000 as compared with $955,000 in 1958-1959. The total aid in scholarships and loans was $430,518 in 1952-1953 and for the current year stands at $1,450,000. Whereas 1,000 students earned $190,000 during the school year 1952-1953, for the current year it is estimated that 1,200 students will earn $500,000.

Speaking on Occupational Health at M.I.T., Dr. Hardy reviewed the work of physicians, chemists, engineers, and radiological safety officers who take every possible step to prevent harmful effects of toxic chemicals, toxic dusts, and damaging levels of radioactivity. In addition to a straight service activity, this group does teaching from time to time in different departments, and has a modest research program in progress. Since 1950 Dr. Hardy has devoted much of her time to the development of the Occupational Medical Service at M.I.T. with the title of Assistant Medical Director.

Dr. Hardy traced the history of the Occupational Medical Service from 1944 when the Institute first engaged consultants from the Massachusetts General Hospital and from the Harvard School of Public Health. M.I.T. was the first educational institution in this country or abroad to undertake this service.

Dr. Hardy described at length the operation of the Occupational Medical Service under its concept of advising and teaching rather than policing. She described the day-by-day work of the Service, citing several extraordinary examples of the emergencies and new situations that are bound to arise in a place where new materials and new techniques are constantly being used or developed.

Dr. Hardy spoke at length about some of the specific problems connected with Lincoln Laboratory with its uses of ever-increasing high energies in microwave work, and the unusual precautions associated with the nuclear reactor and the various high-energy x-ray machines and particle accelerators. Dr. Hardy closed with a brief discussion of some of the research being carried on by members of the staff.

Emeriti Luncheon

■ The annual fall luncheon of members of the M.I.T. Emeriti Group was held on Wednesday, November 19, at the M.I.T. Faculty Club. Thirty-two retired members of the Institute's Faculty and Administration were present. Principal speakers included: Joseph H. Keenan, '22, new Head of the Department of Mechanical Engineering; and J. A. Stratton, '23, then Acting President of the Institute.

Professor Keenan, who has long been recognized as an authority on steam tables, spoke about a trip he had made recently to attend the International Conference on Steam Tables, held in Russia. His comments also included observations on life in Russia and comments on the Russian educational system.

Dr. Stratton spoke very interestingly and earnestly about the long-range plans of the Institute.

Other members of the M.I.T. Faculty whose addresses brightened this annual occasion included: Frederick G. Keyes, Professor of Physical Chemistry, Emeritus; and Jerome C. Hunsaker, '12, Professor of Aeronautical Engineering, Emeritus.

Engineering Our Future

■ Approximately 400 scientists and industrialists, including many Alumni of the Institute, attended the 13th M.I.T. Regional Conference at Albuquerque, N.M., on Saturday, November 8. The conference, held in the Albuquerque National Bank Building, was sponsored by the M.I.T. Club of New Mexico and was devoted to "Engineering Our Future."

Members of the Institute's staff who took part in the program were: James R. Killian, Jr., '26, on leave as Special Assistant to the President for Science and Technology; J. A. Stratton, '23, then Acting President of M.I.T.; George R. Harrison, Dean of the School of Science; Charles S. Draper, '26, Head of the Department of Aeronautical Engineering; and Charles L. Miller, '51, Assistant Professor of Surveying, and Director of the Photogrammetry Laboratory. James W. McRae, Vice-president of the American Telephone and Telegraph Company, and former President of Sandia Corporation at Albuquerque, and James A. Phillips, group leader of the Physics Division, Los Alamos Scientific Laboratory, also delivered addresses.

Frederick J. Given, '19, Vice-president of Sandia Corporation, was toastmaster at the evening dinner, and general chairman for the conference.

During the morning session of this full-day event, Bennett L. Basore, '52, President of the M.I.T. Club of New Mexico, opened the meetings with an address of welcome, and a response was made by J. R. Modrall, chairman of the Board, Albuquerque National Bank. Tom Popejoy, President of the University of New Mexico, was moderator for the morning program, during which Dr. McRae spoke on "The Challenge," and Professor Miller discussed "Civil Engineering and the Future."

The afternoon session was moderated by E. J. Workman, President of the New Mexico Institute of Mining and Technology. Dean Harrison spoke on "Energy and the Future"; Dr. Phillips' topic was "Progress in Using Fusion Energy"; and Dr. Draper's subject was "Space Science."

During the evening session, Dr. Stratton spoke on "Science and the Federal Government." Concluding the addresses, Dr. Killian talked of the future role of scientists and engineers.

A pleasant feature of the evening was the presentation to Mr. Given of an award honoring him as a "Loyal Alumnus of the Class of 1919 . . . whose manifold accomplishments since graduation have culminated in his being 'Mr. M.I.T. of New Mexico.'"

C. E. Redman

John J. Wilson, '29 (left), President of the Alumni Association, presenting certificate to Frederick J. Given, '19.

LeMoyne White: 1914-1958

■ Dr. LeMoyne White, staff psychiatrist in the Institute's Medical Department, died at the Peter Bent Brigham Hospital on December 9, 1958, after a brief illness. In the short time since his appointment at M.I.T. in 1956, Dr. White had made a warm place for himself with both students and staff. He not only brought to the Institute's Medical Department unusual professional skills and experience, but also gave very substantial assistance to M.I.T. admissions and counseling activities.

Born in Los Angeles in 1914, Dr. White was a graduate of the Kent School, Harvard College, and Harvard Medical School. In addition to serving as chief psychiatrist at M.I.T., he was also associate psychiatrist at the Massachusetts General Hospital, and on the teaching staff of the Harvard Medical School. Dr. White took his psychoanalytical training at the Boston Psychoanalytic Institute. During World War II, he was a flight surgeon with the Army Air Transport Command.

Dr. White had also been associated with the Boston Psychopathic Hospital, the Harvard School of Public Health, and the Massachusetts Eye and Ear Infirmary.

Dr. White is survived by his wife, Mrs. Alice Patricia Farley White, and four children – Wendy Pierrepont, Benjamin LeMoyne, Stephen Eliot, and Cornelia Farley White – and his father, C. Carroll White. His home was at 29 Hilltop Road, Chestnut Hill, Mass.

Twenty-five Years Ago This Month . . .

■ Editor James R. Killian, Jr., '26, in The Review for January, 1934, observed that "air transport is developing so rapidly that articles about it are almost sure to be out of date when they finally reach the reader." Nevertheless, he thought "the chance is worth taking," and commissioned Daniel C. Sayre, '23, to tell what the airlines had accomplished up to then in providing quiet, comfort, and reliability.

"It is going to be difficult," began Author Sayre, "to get used to the idea of airplane transportation as a middle-aged institution, but it did have its 30th birthday a few weeks ago. Nothing can get past that milestone and still be considered a youngster except an occasional movie star, the Prince of Wales, and some geological processes.

"Even more strange to those who knew the airplane in its rugged youth is the increasing attention designers and operators are paying to such middle-aged things as quiet, comfort, and a reputation for safety and reliability. Not so many years ago an airplane passenger received about the same consideration as a customer on an amusement park roller coaster, who is told to hold his hat and not stand up, and then sent off in a rush of noise, wind, and nausea.

"An airplane is no magic carpet even now, but the trend toward gentility is on. Booking agents already are looking you in the eye and urging airplane travel not only because it is faster, but also because it is cleaner, more comfortable, and even quieter.

"As long as the design of the entire airplane was left up to the aeronautical engineer, little progress was made in reducing the noise level within the cabin . . . [but] when the acoustical experts were finally called in, [they realized] the possibility of insulating the cabin interior from the source of the noise. . . . Special care is taken in insulating by rubber the frame of the airplane from engine vibration at the engine mounts. The floor, chair supports, windows, and ventilating and heating system are in turn rubber insulated from the frame. . . . The future may see quieter running engines and geared propellers . . . but in any case the noise level is now reduced to 70 decibels, or somewhat below that in Pullmans, which run between 70 and 80 decibels.

"Less spectacular than the new quiet, but also adding greatly to passenger well-being, are recent trends in ventilating and heating. Gone are the direct exhaust pipe heaters and open-window ventilation systems. . . . Heat control is thermostatic, and a temperature of 70° F. can easily be maintained with sub-zero external conditions. . . .

"The new cabins are roomier, with six-foot headroom, 40-inch seat spacing, and wider aisles. Airplane chair design has been carried to the ultimate in posterior luxury. . . . The air passenger is also provided with free reading material, maps of the route, and periodic hot bouillon snacks. . . . On some airlines the stewardesses serve substantial meals in flight, which obviously limits the menu choice . . . [but] they make no charge for them.

"Infinitely more serious, of course, than any considerations of creature comfort are those of operating safety and reliability. Unfortunately, the problems encountered are correspondingly more difficult. It would appear from what statistics are available that the airlines since the opening of the passenger-carrying era have stressed (and quite rightly) progress toward safety rather than heroic attempts to complete all scheduled flights. . . . Technical advances in engine and airplane design, in de-icing equipment, in flight instruments, and in radio aids to navigation have so far proved effective in bettering the safety record, and increasing regularity.

"The chief major technical difficulty now between present percentages of schedules flown and perfect achievement is that of blind landing equipment and technique. The magnitude of this problem must not be underestimated. It is true that several different types of equipment have proved experimentally successful. It is also true that three airports are at present equipped with landing beams. The popular idea, however, that airlines will be making routine all-fog flights within a few months is far too optimistic. . . . A few years, rather than a few months, will be needed.

"But some day come it must and with it one of the most spectacular achievements in modern transportation; spectacular, that is, from the point of view of the transportation operator. . . . When the take-off, trip, and landing are all carried out in fog, the view from the cabin will closely resemble that from a white-tiled subway without stations. . . . Even in clear weather, the average passenger finds plane travel rather dull, unless he can interest himself in large-scale structural geology or the vagaries of cloud formations. . . ."

Decade in Review

Photo by Arthur Griffin

Inauguration of James R. Killian, Jr.,'26, took place in Rockwell Cage on April 2, 1949, as Karl T. Compton turned over the Institute's charter to the first Technology graduate to become President of M.I.T.

Remarkable growth and activity marked M.I.T. progress during the Killian administration

A TECHNOLOGY REVIEW REPORT

MOMENTOUS changes took place at M.I.T. a decade ago. Under the heading, "New Era for Technology," the November, 1948, issue of The Technology Review announced a change in the administration of M.I.T. in these words:

"Acting on the recommendation of Karl Taylor Compton, since 1930 President of M.I.T., the Corporation elected James Rhyne Killian, Jr., '26, to become the next, and tenth, president of the Institute, at its meeting on October 4. In his new position, Dr. Killian is the first graduate of M.I.T. to have the honor of becoming its president."

At its meeting on December 1, 1958, the M.I.T. Corporation: (1) advanced Dr. Killian to the post of Chairman of that body; (2) elected Julius A. Stratton, '23, to be the 11th President of M.I.T., effective on January 1, 1959; and (3) named Vannevar Bush, '16, to the newly created post of Honorary Chairman of the Corporation. These actions of the Institute's corporate governing body have already been reported to Review readers by means of a special announcement printed at the last minute, just in time to be bound in the December, 1958, issue as a separate tip-in, page 64A.

As a new year opens and a new administration becomes responsible for managing M.I.T. affairs, it is appropriate to review the major events that have taken place during the decade of Dr. Killian's administration – October 4, 1948, to January 1, 1959. In a world which daily becomes increasingly dependent on excellence in education, it is also proper to try to place the achievements of this significant period in perspective with regard to the Institute's present hopes, aspirations, and needs.

Certainly, William Barton Rogers faced unusual difficulties in founding the Massachusetts Institute of Technology, Francis Amasa Walker had to clear many hurdles in transforming a struggling new school into the nationally known "Boston Tech," and Richard C. Maclaurin undertook a herculean task in establishing a new M.I.T. in its present Cambridge location. During the great depression Karl T. Compton developed the Institute's School of Science into one of the nation's strongest. Through his own personal example he brought a new concept of public service to the academic environment, established the Radiation Laboratory as the first great co-operative university research organization engaged in national service, and during World War II transformed the Institute into a training center whose primary concern was preservation of a free way of life.

The Tech

Before an overflow audience in the Boston Garden on April 1, 1949, President Killian presented to Sir Winston Churchill a certificate designating him as honorary lecturer at M.I.T. Joining in the general applause were Karl T. Compton, John E. Burchard, '23, and former Governor Paul A. Dever.

TABLE I

CHANGES IN CERTAIN M.I.T. OPERATIONS DURING PAST DECADE

Year	No. of Undergraduate Students	No. of Graduate Students	No. of Faculty Members	Other Staff Members	Total Academic Expenses	Indirect Expense Applicable to Sponsored Research	Total Invested Funds	Gifts and Grants	Book Value of Educational Plant
1948-49	3,831	1,602	435	861	$ 9,990,055	$ 398,111	$47,174,682	$ 2,536,802	$22,243,619
1949-50	3,856	1,602	436	940	10,861,349	430,382	50,994,003	6,528,089	24,213,962
1950-51	3,496	1,675	457	999	11,042,789	465,343	54,409,586	9,145,107	28,577,539
1951-52	3,154	1,720	480	1,051	12,501,288	623,430	57,771,329	6,953,106	31,364,731
1952-53	3,153	1,921	503	1,092	13,673,213	798,451	59,939,591	6,231,894	33,064,982
1953-54	3,227	1,956	515	1,047	13,692,928	1,031,915	63,083,524	5,117,043	34,417,430
1954-55	3,481	1,867	534	1,105	14,812,395	1,122,802	71,830,729	7,074,857	36,086,005
1955-56	3,656	1,992	582	1,177	17,098,759	1,157,828	79,292,272	10,387,287	37,9?9,971
1956-57	3,688	2,312	607	1,249	19,488,774	1,333,492	84,161,131	8,498,000	41,308,735
1957-58	3,664	2,515	625	1,324	20,905,396	1,549,079	88,374,694	7,732,039	43,250,972

Exceedingly difficult problems, unusual in scope and magnitude, have likewise been encountered in the past decade. The brilliant administration of M.I.T. affairs during this period has enhanced the Institute's leadership and brought it extraordinary international responsibility.

Campus Changes

The major changes on the Institute's campus that have occurred during President Killian's administration have radically altered the face of a sizable portion of Cambridge. The ground area of the Institute's physical plant has increased about 50 per cent, the book value of its educational plant has doubled in the past decade, and excellent progress has been made toward transforming M.I.T. into a residential college. Undergraduate enrollment today is substantially unchanged from what it was a decade ago, but the total student body showed a gain of 14 per cent due to 57 per cent increase in the number of graduate students. As may be deduced from Table I, the number of Faculty members increased 43.5 per cent, and total academic expenses more than doubled in the last decade. Although total invested funds have increased 88 per cent, during the Killian administration, Table II shows that today only 9 per cent of M.I.T. income is derived from investments, compared to 13 per cent a decade ago.

TABLE II

HOW M.I.T. OBTAINS AND SPENDS ITS MONEY

INCOME

Item	1948-1949	1952-1953	1957-1958
Tuition	$3,705,424	$3,806,320	$6,485,329
Investments	1,323,607	1,450,613	1,913,101
Gifts and Other Funds	2,189,252	2,985,157	4,480,543
Research Contracts Indirect Income	1,489,028	3,772 878	6,211,252
Housing and Dining	1,223,023	1,678,818	1,815,171
Total	$9,930,334	$13,693,785	$20,905,396

EXPENSES

	1948-1949	1952-1953	1957-1958
Academic Expenses	$5,040,601	$5,837,880	$8,717,623
General Administration	2,341,776	3,501,387	7,149,325
Plant Operation	1,404,784	2,656,110	3,209.859
Housing and Dining	1,202 893	1,677.836	1,828,589
Total	$9,990,054	$13,673,213	$20,905,396

Since the end of World War II, much of the Institute's program has been greatly influenced by continued international tensions which, in 1950, broke out into the Korean War. Throughout the nation, the demand for technically trained personnel substantially exceeded the supply during all of the past decade. In a world of technology, modern requirements for national defense required the Institute to engage in research projects of unprecedented scope and magnitude. Indirect income from research now provides 30 per cent of the Institute's income as against 15 per cent a decade back.

In October, 1957, the launching of the first artificial satellite catalyzed action to maintain the nation's leadership in science and technology as nothing else had done. In a very real sense, the force of world events required President Killian to take leave of absence from his M.I.T. post in November, 1957, for his extraordinary abilities were required to serve the nation as Special Assistant for Science and Technology to the President of the United States. Thus was set into motion a chain of events which, as of January 1, 1959, opens another "new era for Technology" under the administration of President J. A. Stratton, '23.

Underlying, and basic to, the vast program which marks Technology's progress over the past 10 years, is the continued emphasis on improving the Institute's educational program. It is especially in this area that the Institute's new president has worked quietly but effectively, with Dr. Killian for many years. Indeed, as M.I.T.'s first Provost, Dr. Stratton's major concern was to make certain that the Institute's teaching program was modernized so as best to meet today's exacting educational requirements; later, as Chancellor, administrative problems at the highest level were also added to Dr. Stratton's responsibilities.

Thus, in reviewing the events of the past decade, it is comforting to know that Dr. Killian and President Stratton have worked together for many years, unceasingly and harmoniously, to promote the Institute's primary objective – excellence in education.

Sam Vandivert

Upon successful conclusion of the campaign for funding the Institute's independence, a Victory Dinner was held at New York's Waldorf-Astoria Hotel on May 3, 1951, to honor Alfred P. Sloan, Jr.,'95, and members of the Committee on Financing Development. Mr. Sloan is shown receiving a volume of 2,000 signatures in testimony of his leadership in American industry and education.

Mid-Century Convocation

Two major events early in Dr. Killian's administration brought the Institute into sustained nationwide public attention. The first of these was the Mid-Century Convocation in April, 1949; the second was the launching of the important program of the Committee on Financing Development.

The May, 1949, issue of The Review — an issue that broke all records in its size and circulation — recorded that "Boston and Cambridge were the focal points of world-wide attention when the Massachusetts Institute of Technology held its Mid-Century Convocation on the Social Implications of Scientific Progress on March 31 and April 1, to be climaxed on April 2 by the inaugural of James R. Killian, Jr., '26, as the 10th president of Technology. The combined convocation and inauguration was the occasion for hundreds of scholars, administrators, and other leaders in the field of education to come to M.I.T., to listen to major addresses by the Right Honorable Winston Churchill; Harold E. Stassen, President of the University of Pennsylvania; James R. Killian, Jr., '26, first M.I.T. graduate to become its administrative head; Karl T. Compton, Chairman of the M.I.T. Corporation; and John E. Burchard, '23, Dean of the School of Humanities and Social Studies. It was the occasion for nearly three dozen eminent scholars to examine the material, spiritual, and intellectual aspects of Twentieth Century progress, which has been dominated very largely by science and technology. It was the occasion for 18,000 Alumni and other friends of M.I.T. to converge on Cambridge and Boston in such numbers as seriously to tax living accommodations which these two cities had to offer. Even Boston's largest hall — the Garden — with a capacity of 13,909 could not seat at one time all those who were drawn 'back to Tech' by the brilliant three-day event."

By word and photograph this auspicious event was adequately chronicled in the May, 1949, issue of The Review. The scholarly addresses and discussions on the social implications of science were merely summarized in this contemporary account of events, but are recorded in detail in the book *Mid-Century: The Social Implications of Scientific Progress,* published by the Technology Press of M.I.T. and John Wiley and Sons, Inc. of New York.

The largest single gathering ever to attend an M.I.T. event took place on April 1, 1949, when Sir Winston Churchill delivered his address, "The Twentieth Century — Its Promise and Its Realization," to a capacity audience at Boston Garden. An overflow "was accommodated in the Rockwell Athletic Cage in which about 3,500 persons saw and heard Winston Churchill make his address" by television. Sir Winston's message might be summarized by the following quotation from his address: "Those whose minds are attracted or compelled to rigid and symmetrical systems of government should remember that logic, like science, must be the servant and not the master of man." At the conclusion of this address, Mr. Churchill was presented with a certificate making him an honorary lecturer of M.I.T., which does not award honorary degrees.

Inauguration

Climax of the three-day celebration was the impressive and colorful ceremony in which Dr. Killian was inaugurated as Technology's 10th president. In addition to 500 academic delegates, 4,500 persons in Rockwell Athletic Cage and an overflow of 1,400 in the Great Court were on hand for the great occasion.

In his address of welcome, Dr. Compton made brief and modest reference to his own administration:

"The intervening years have been full of emergencies and problems; first the great depression; then the slow recovery; then the great World War; then the period of reconversion to peace; and now the threshold of a new era. Through these vicissitudes the institution has weathered its difficulties and has exploited its new opportunities and has come through stronger than ever before.

"I am convinced that this successful record is due to several factors. One of these is the complete devotion of the administration and staff to their respective duties. Another is the unswerving decision to place service to the public ahead of personal or institutional gain. Above all, there has been clearly proven the essential value of the Institute's purpose and performance."

At the conclusion of Dr. Compton's address, President Killian was invested with the symbol of his office by conveying to him the Institute's charter of incorporation, as shown in the illustration at the head of this article. For a brief moment photographers' flashbulbs intermittently illuminated the scene as though a Fourth of July celebration were in progress. When this display of artificial lightning was over, President Killian delivered his inaugural address, which appeared in the May, 1949, issue of The Review. Perhaps the theme of Dr. Killian's inaugural address may be summarized by his remark, "Our preoccupation in America with the common man should not let us forget that our advancement depends upon the uncommon man. This is particularly true in education."

Photos—M.I.T. Photographic Service unless otherwise indicated

Symbolic of the Institute's two schools which were brought into being during the past decade are the Sloan Building (left) *housing the School of Industrial Management and the M.I.T. Faculty Club, and the Exhibition Gallery* (right) *in the Hayden Memorial Library, in which the School of Humanities and Social Studies is located.*

Development Program

In January, 1949, the 50th anniversary issue of The Review recorded the opening of a major program for funding M.I.T.'s independence. The golden anniversary issue comments: "Charged with the responsibility of raising $20,000,000 for additional endowment and for new facilities for M.I.T., the Committee on Financing Development will have the leadership of two nationally known Alumni: Marshall B. Dalton, '15, President of the Boston Manufacturers Mutual Fire Insurance Company, and of the Mutual Boiler Insurance Company; and Alfred P. Sloan, Jr., '95, Chairman of the Board of General Motors Corporation." Aiding these men as Assistant Executive Director of the Committee on Financing Development was Ralph T. Jope, '28, then, as now, Business Manager of The Review.

The aims and purposes of the development program were outlined by President Killian in an article, "Funding M.I.T.'s Independence," in The Review for January, 1949. The President's Report for 1949 also recorded the launching of the Development Program. In 1950, President Killian was able to record that the fund had reached the $15,500,000 mark. Two years after the program was launched, its leaders (who had worked actively and harmoniously with 700 other loyal Alumni) readily achieved the stated goal. The Victory Dinner in New York's Waldorf-Astoria Hotel on May 3, 1951, honoring Alfred P. Sloan, Jr., '95, marked the successful completion of this fund, which exceeded the original goal by $5,000,000, for the fund was overscribed by 25 per cent.

A few years later, Messrs. Sloan and Dalton again volunteered to raise funds, this time for new science laboratories to be erected as a memorial to President Karl T. Compton, whose untimely death occurred on June 22, 1954. Once more the stated goal was readily achieved, and on January 4, 1956, its successful completion was again announced at the Waldorf-Astoria.

The Institute's Educational Program

Although of fundamental importance, progress made in advancing the Institute's teaching and educational program is not easily displayed. No tangible, physical monument is erected for good teaching, nor would architectural structures adequately reflect the real worth or true value of an extraordinary educational program. Yet the world looks to, and depends upon, exceptional students and the excellence of their education for its betterment.

The increasing scope and importance of the Institute's educational program was emphasized in 1949 with the establishment of the new position of Provost, to which J. A. Stratton, '23, was appointed, effective on April 15. In announcing the appointment of Dr. Stratton, the June, 1949, issue of The Review reports President Killian as saying:

"The Corporation and my associates in the Institute's Administration feel that Professor Stratton is ideally qualified for educational administration. His background both in electrical engineering and physics, his brilliant direction of the Research Laboratory of Electronics, and his membership on the Institute's Committee on Educational Survey have provided him with an extraordinarily rich background for his new responsibilities. To all of his many assignments at the Institute he has brought a depth of understanding of education and of research which will be of inestimable value to our over-all program. I am personally delighted and reassured to have him as an administrative colleague and to have available his wise and judicial counsel in discharging my own duties as president."

Colleges have fiscal as well as educational problems and a brief summary of the Institute's financial operations over the past decade is given in Table II. Dormitory operations (housing and dining) are self-supporting, but income from tuition meets only two-thirds to three-quarters of academic expenses and leaves nothing for administration or plant operation.

In 1949 a degree of professional engineer was authorized by vote of the Faculty. This degree was to be awarded to persons who had completed an educational program at the doctorate level but whose anticipated professional careers would not require conduct of original research. About the same time, the Chemical Engineering Practice School at Oak

Gottscho-Schleimer

Devoted to scientific and engineering studies on the structure and behavior of metals, the Metals Processing Laboratory (left), *dedicated on June 3, 1952, is administered by the Departments of Metallurgy and of Mechanical Engineering. The Dorrance Building* (right), *dedicated on June 25, 1953, tallest structure on campus, houses the Department of Biology and the Department of Food Technology.*

Ridge, Tenn., began to attract students in mechanical, nuclear, and electrical engineering as well as in chemical engineering.

A Faculty Committee on Educational Survey, appointed in 1947 by President Compton, completed its study of postwar educational policy and in 1950 issued a thought-provoking report which was to guide future M.I.T. programs. A broader and more intense program of study for M.I.T. students was recommended by the Committee, including establishment of a School of Humanities and Social Studies to recognize and emphasize the importance of general studies in the education of scientists, engineers, architects, and managers.

Two New Schools

In 1950 the School of Humanities was established with John E. Burchard, '23, as its dean. About the same time, the School of Industrial Management was also established, under the stimulating guidance and interest of Alfred P. Sloan, Jr., '95. Former Vice-president of Sears, Roebuck and Company, E. P. Brooks, '17, became dean of that School in 1951. Thus, in rapid succession the Schools of Engineering, Science, and Architecture, with which M.I.T. had made a great reputation, were joined by two new schools.

With the Korean War in progress, increasingly serious attention was given to "the road ahead" in Technology's educational program. Enrollment in the Graduate School took a sudden upswing. Greater effort, than at any time since the end of World War II, was devoted to national defense aspects of research and education, and members of the Institute's Faculty and staff undertook several confidential "project studies" for the United States government. One of these subsequently led to the establishment of the Lincoln Laboratory.

In his annual report for 1952, President Killian emphasized the conviction that the undergraduate program is the core of M.I.T. activity. Although scientists and engineers continued "in short supply," the Freshman Class entering in 1952 increased more than 200 over the class which entered a year earlier: instead of 800 planned for, 943 students enrolled.

The Charles Hayden Memorial Library (left) *is the principal depository for the Institute's library of 634,000 volumes and 3,100 periodicals, and also houses offices of the School of Humanities and Social Studies. It was dedicated on May 19, 1950. The Karl Taylor Compton Laboratories building* (right) *was dedicated on June 10, 1957. It is headquarters for the Research Laboratory of Electronics and for the Laboratory for Nuclear Science, and contains a large lecture hall for undergraduate instruction in physics.*

Located in a beautiful and secluded section of Dedham, the Endicott House is frequently used for conferences, symposia, or study groups who find its environment pleasant and intellectually stimulating.

The School of Industrial Management got well under way, first by moving into the new Sloan Building and then by graduating 48 students and enrolling 18 Sloan Fellows in a new program of executive development.

A year later, 1953, two groups of 17 men each began a new Sloan program for Executive Development. The first year curricula at M.I.T. were modified to permit freshmen greater flexibility in choice of study subjects and to reduce the number of required classroom hours; at the same time, the program of general education at M.I.T. was recast. The Department of Building Engineering and Construction was consolidated with the Department of Civil and Sanitary Engineering, and a Division of Biochemistry, within the Department of Biology, was established. As the Department of Biology was able to move from Building 10 into new quarters, in the recently completed Dorrance Laboratories, the Department of Electrical Engineering expanded to occupy space on all floors of Building 10. The increased enrollment and limited space for all who desired a Tech education made it necessary to limit the number of incoming students.

The Kresge Auditorium (rear) and M.I.T. Chapel (right foreground) are the focal points of the Institute's social, religious, and music activities. The Auditorium seats about 1,200 people in its main section, and another 200 in its Little Theater.

Departures in laboratory instruction in physics and in the curricula of the Department of Electrical Engineering were among the major educational activities recorded in the 1955 President's Report. Electrical Engineering laboratories on the first two floors of Building 10 were completely modernized; the large, expensive, inflexible motors and generators, which had limited value as educational and research tools, were replaced by smaller and more flexible energy-conversion devices as emphasis in electrical technology changed from power generation and distribution to servomechanisms, control, and automation.

During 1955 the Faculty voted to award the Sc.D. degree in Nuclear Engineering, as this branch of technology assumed increasing importance. With the opening of the 1955 Summer Session, tuition at M.I.T. was increased from $900 to $1,100 per year. During 1955 the Faculty approved establishment of Course XXI, interrelating science, engineering, and the humanities, and the new laboratory programs in physics and electrical engineering attracted nationwide attention.

Event of the Year

According to President Killian's annual report for 1956, "The most notable event of the year was the election of Julius A. Stratton, '23, to the newly established post of Chancellor." Primarily engaged in advancing the Institute's educational program as Provost, Dr. Stratton's responsibilities in high-level administration were substantially increased with his new appointment. But increased duties, which placed a heavy burden upon him, were also coupled with unusual opportunities to prepare Dr. Stratton for the still greater presidential duties that were soon to fall upon his shoulders.

A School for Advanced Study was evolved and its formation was announced in New York on January 4, 1956. Martin J. Buerger, '24, was named director of the new M.I.T. facility for post-doctoral scholars. During the summer of 1956, a Naval Reserve Officers' Training Corps unit was added to the Institute's program in Military Science. The 1955-1956 school year was also marked by ground-breaking ceremonies for a nuclear reactor to be built on Albany Street in Cambridge, a short distance from the Institute's main educational buildings. By vote of the Faculty, the Department of Meteorology was authorized to discontinue its undergraduate program as of June 1, 1956, in order to devote its entire efforts to graduate work.

With the public becoming acutely aware that American education was lagging behind modern needs of a highly industrialized and technological nation, President Killian's report for 1956 devoted considerable attention to recommendations of President Eisenhower's Committee on Education Beyond the High School. Colleges had already felt the effects of inadequate preparation on the part of too many of their entering freshmen and the deficiency was most apparent in science curricula. To offer effective aid in improving the teaching of high school physics, M.I.T. sponsored the Physical Science Study Com-

mittee. Scholars from all parts of the nation joined this group and worked effectively to develop new textbooks, laboratory apparatus, motion picture films, and other educational aids for high school physics teachers and students. During the 1956-1957 academic year, the School of Industrial Management celebrated its first five years of operation, and Course VI-B, in Electrical Science and Engineering, was authorized by vote of the Faculty.

Significant Appointment

The Institute's educational program felt the effects of launching of the first Sputnik when Dr. Killian was called to a new and highly important post in Washington,' in November, 1957. Accordingly the annual report to the M.I.T. Corporation for 1958 was made by Acting President Stratton. In his report for the year, Dr. Stratton remarked:

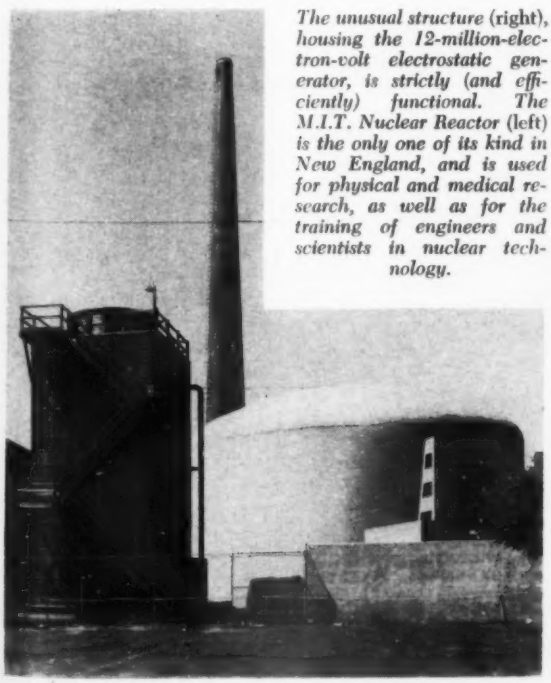
"The most significant event of the academic year 1957-1958 was the appointment last November of Dr. James R. Killian, Jr., as Special Assistant for Science and Technology to the President of the United States. He was called to Washington at a moment when M.I.T. was most in need of his great, constructive energy. But on the larger national scene, his departure reflected a mounting concern for the state of science in this country. It was evidence of a new national awareness that the hopes for our survival as a free and prosperous nation rest in large measure upon the quality of our education and upon our capacity for scientific research."

Emphasizing excellence in education in his report, as he had so often done in his teaching, research, and administrative careers, Dr. Stratton also reported:

"Public service, defense research, and the broad advancement of scientific knowledge are essential parts of the total mission of M.I.T. But we bear ever in mind that our first obligation, our foremost concern, must be for the education of our students. . . . There rests upon such an institution as ours . . . a heavy responsibility to provide the highest standards of excellence, to set new patterns, to give leadership, and to lift the sights of all."

Specific actions occurring during the year that lent emphasis to Dr. Stratton's remarks were: (1) the establishment of the Department of Nuclear Engineering and completion at M.I.T. of the first stationary nuclear reactor in New England; (2) the initiation of the Karl Taylor Compton lectures delivered by Nobel laureate Niels Bohr; (3) transfer of the successful work of the Physical Science Study Committee to the newly formed Educational Services, Inc.; (4) Faculty authorization to award the Ph.D. degree in Political Science; (5) establishment of a new Center for Communications Sciences; and (6) formation of the Mitre

The I.B.M. 704 computer, in a special one-story wing of the Compton Laboratories, is used co-operatively by colleges in New England on an "around-the-clock" basis.



The unusual structure (right), *housing the 12-million-electron-volt electrostatic generator, is strictly (and efficiently) functional. The M.I.T. Nuclear Reactor* (left) *is the only one of its kind in New England, and is used for physical and medical research, as well as for the training of engineers and scientists in nuclear technology.*

Burton House (above) *and Baker House* (below) *accommodate about 900 students. Acquisition and construction of these dormitories have gone a long way toward transforming the Institute into a residential college.*

Corporation to undertake major responsibility for systems research for air defense. Thus the Lincoln Laboratory, under the able direction of Carl F. J. Overhage, and M.I.T. itself should ultimately become free to devote a greater portion of their efforts to academic research, rather than to the development of "hardware" for national defense. These events, under Dr. Stratton's interim appointment as the Institute's acting chief executive, are clearly concordant with those initiated by President Killian, and earlier, by President Compton.

Beginning with the fall semester in 1958, tuition at M.I.T. was increased to $1,300 for the school year. Before leaving this topic it is interesting to observe that the ratio of students to Faculty members, which stood at 12.5 for the 1948-1949 academic year, has steadily dropped to 9.9. Efforts are being made to raise Faculty salaries which, on the whole, have not kept pace with the rise in the cost of living.

Research

Closely allied to the M.I.T. educational program, and indeed nurturing it at the advanced levels, is the Institute's intense program of research. During the French Revolution, Lavoisier paid with his life for the common man's belief that "the Republic has no need for scientists," but World War II demonstrated – if nothing else had – that in many ways science and research pay handsome dividends and may even be the means of preserving the republic.

Each year, more and more Alumni take part in the program ► of Alumni Day activities in which a major attraction is the luncheon in the Great Court, with messages from the Institute's leading administrators.

In his 1950 annual message, President Killian was able to report that, stimulated in part by the needs of World War II and the Korean War, research at the Institute was then at a new level. The Project Lincoln study had been successfully completed, and 18 major research programs were selected for mention in the President's Annual Report.

During the next two years: (1) the number and value of M.I.T.'s research contracts showed a sharp rise; (2) Project Lincoln was housed in new buildings at Lexington, Mass.; (3) the Instrumentation Laboratory on the Cambridge campus was reported actively engaged in classified research related to aeronautics; and (4) need was expressed for re-examining the method of handling the Institute's rapidly growing contracts for sponsored research.

During 1953, the Division of Defense Laboratories was set up to handle government-sponsored research more effectively. A new Combustion Laboratory was built on the third floor of the Gas Turbine Laboratory. President Killian also reported that Harvard and M.I.T. had combined their efforts and resources to design, build, and operate a six-billion electron-volt accelerator which is now under construction in Cambridge.

Since it organized and operated the Radiation Laboratory during World War II, M.I.T. has been internationally recognized for its contributions in adapting technology to national defense. In 1956 the Institute joined four other universities in establishing the Institute for Defense Analyses, the primary objective of which is to study all phases of technological national defense.

In 1956, while plans for the Karl Taylor Compton Laboratories were being prepared, enlargement of this new research building had to be provided to house a new large and flexible digital computer for an M.I.T. Computation Center. Contributed by the International Business Machines Corporation, this computer is the largest now available exclusively for educational purposes, and M.I.T. joins other colleges in New England in using the I.B.M. 704 on an unusually heavy operating schedule. The SAGE (Semi-Automatic Ground Environment) System of intercontinental defense (employing a network of radar stations interconnected to high-speed electronic digital computers) as developed by Lincoln Laboratory, was also announced in 1956.

In 1956-1957, research on the atmosphere, land, and sea took a major forward step as the Department of Meteorology and the Department of Geology and Geophysics combined their efforts with those of the Woods Hole Oceanographic Institution to organize a Laboratory of Earth Sciences. As part of the Karl Taylor Compton Laboratories in science, a $2,400,000 nuclear reactor was designed and projected for future operation in Cambridge. During the year, ground was also broken for the $6,500,000 Cambridge Electron Accelerator which will be operated by Harvard and M.I.T.

In 1956 restrictions were removed on certain classified work that had been going on in the Instrumentation Laboratory under the direction of Professor Charles S. Draper, '26. Thus, two years ago, it could be revealed that tremendous progress had been made in developing inertial guidance systems which made possible automatic and controlled navigation over land and water, or in the air, by methods no longer requiring dependence on the earth's magnetic field or observations of the stars. Development of the paramagnetic microwave amplifier, depending for its performance upon solid state phenomena was also announced as having been accomplished at Lincoln Laboratory.

In the annual report, presented to the M.I.T. Corporation last October, Dr. Stratton announced that the M.I.T. Nuclear Reactor had been put into suc-

Associated Photographers

Regional Conferences in cities remote from M.I.T. have ► grown in importance and popularity since they were initiated in Chicago in 1951. At the Regional Conference in Pittsburgh on December 7, 1957, J. A. Stratton, '23 (left), congratulates Irving W. Wilson, '11, who received a citation from Gilbert M. Roddy, '31 (right), President of the Alumni Association.

Attending commencement exercises in June, 1956, were these distinguished leaders in American education and industry — all of whom have since assumed even greater responsibilities in national or educational service. James R. Killian, Jr.,'26 (left), then President of M.I.T., is now Chairman of the M.I.T. Corporation, and Special Assistant for Science and Technology to President Eisenhower. Neil H. McElroy (center), then President of Procter and Gamble Company, and 1956 commencement speaker, is now Secretary of Defense. Julius A. Stratton, '23 (right), in 1956 Chancellor at M.I.T., becomes President of M.I.T., effective January 1, 1959. Evidently, promotion to greater responsibilities would seem to follow those who play a major part in Technology's commencement program.

cessful operation in August, 1958. Research at M.I.T. continues at a rapid pace, but, warned Dr. Stratton, "it seems imperative, however, that some form of long-term funding of government sponsored research programs be adopted with ample warning of termination."

The Little Red School House Expands

A considerable expansion in the Institute's physical plant has taken place in the past decade, as is recorded in Table III. Buildings erected since 1948 may exceed in space and value those erected at any other decade in M.I.T.'s history.

During the school year of 1948-1949, that portion of the Hayden Library devoted to the School of Humanities and Social Studies (dedicated in 1950) became occupied, and the Supersonic Wind Tunnel (on Memorial Drive near the Tech Boat House), had been completed. Construction was begun on a 12-million electron-volt electrostatic generator, and on a Hydrodynamics Laboratory and Towing Tank. A grant from Alfred P. Sloan, Jr., '95, also enabled the Institute to plan for a Metals Processing Laboratory.

During the following year, the Riverside Apartment Hotel (on Memorial Drive a few blocks west of Massachusetts Avenue) was purchased for reconversion to a student dormitory. This addition permitted demolition of Building 22, a temporary structure erected during World War II and pressed into service as a barracks for students during the peak of postwar enrollment of veterans. Also in 1950 construction was started on the Metals Processing Laboratory. Plans for the Dorrance Laboratories of

Cambridge's loss is Washington's gain. In his M.I.T. office, James R. Killian, Jr.,'26, confers with members of the press, following the announcement on November 7, 1957, by President Eisenhower, that Dr. Killian had been named Special Assistant for Science and Technology.

TABLE III

ADDITIONS TO PHYSICAL PLANT — 1949 TO 1958

Year	*Property*	*Area (sq. ft.)*	*Value*	*Use*
1949	Baker House	135,650	$2,576,186	B
	Briggs Field House (and Track)	6,500	121,198	C
1950	12 MEV Electrostatic Generator	9,452	278,255	A
	Hydrodynamics Laboratory and Towing Tank	25,775	618,041	A
	Hayden Library	148,773	3,883,441	A
	Burton House, Acquired	145,800	2,028,065	B
1951	Sloan Building, Acquired	126,157	2,852,051	A
	Dean's House, Acquired	12,023	75,000	B
1952	Metals Processing Laboratory	67,507	1,194,576	A
	Dorrance Laboratories	108,835	3,222,304	A
1955	Kresge Auditorium	43,900	2,614,352	C
	M.I.T. Chapel	4,160		C
	Endicott House	25,800	275,000	D
1957	Compton Laboratories (and I.B.M. Computer)	134,400	3,707,483	A
	National Guard Armory	63,995	375,000	C
	Religious Counselors' House, Acquired	3,786	30,406	C
1958	Nuclear Reactor	11,773	2,468,457	A

A-Academic; B-Living Groups; C-Medical, Athletic, Recreational; D-Special and Misc.

Biology and Food Technology were also formulated, as a substantial grant from the Campbell Soup Company made this much-needed facility possible. The Hydrodynamics Laboratory and Towing Tank was put into use, and Hayden Library was dedicated in May, 1950. A conference room for use by students of the Department of Electrical Engineering and named in honor of Dugald C. Jackson, Head of the Department of Electrical Engineering from 1907-1935, was dedicated on Alumni Day 1950.

(*Continued on page 158*)

Louis R. Nelson, '59

Science, Engineering and the Humanities

How can our educational process be evolved to form a consistent whole, with the educated person separated from the technician by understanding what he knows?

by ROBERT S. WOODBURY

The training of our scientists and engineers has been a matter of public concern in recent months, but the discussion has focused primarily on technical training in science and engineering. Our leaders have warned us of the inadequate numbers of scientists and engineers we are producing, not only for our military purposes but for peaceful needs. Although it seems quite probable that we do need more scientists and engineers, one may suspect that mere numerical comparison with the Soviets is hardly a sound basis on which to rush into a "crash" program aimed only at turning out large numbers of people with these highly important skills. Of late there has been more talk of quality of training; a few have suggested that we have an adequate supply of men trained for our ordinary scientific and engineering requirements, that what we need is more of the top-flight talent – the really creative scientists and engineers, the men who will make the great fundamental advances.

Until the recent satellite successes, the free world felt rather satisfied that we had deservedly more than our share of the best scientific and engineering minds. There have also been some serious programs to improve the methods of teaching our future scientists, both at the preparatory and at the college levels. A word or two has even been whispered that the methods of graduate training could be substantially improved. This is all encouraging and important, but is it enough? Are technical knowledge, skill, and creativity – no matter how efficiently imparted or developed, on how high a level, or how widespread – are these enough if science and technology are to play the part they must in a world at once somewhat afraid of them and at the same time hopeful that they will give us the answers to the great problems of these troubled times?

Something more is required. It is required in our scientists and engineers not only that they may more deeply serve society as a whole but also that this "something more" be included as a necessary part of their special work as scientists and engineers. Since the first military atomic bomb exploded over Hiroshima, not a few of our most distinguished physicists have rediscovered the world of values, especially the conscience; they feel that they have sinned. But some of their pronouncements on the moral implications of "this monster that we have created" are hardly worthy of a term paper in a first college course in philosophy, much less do they show a broad perspective and a deep understanding of the meaning of scientific and technical advance for the future. What then is required?

Too little has been said about the *education* of our scientists and engineers. May it not be that our present doubts of their capabilities and wisdom stem from the fact that all too frequently they are not educated men? But shall we call a doctor of philosophy an uneducated man? Or can we perhaps say that Ph.D.'s in physics, chemistry, biology, or mathematics are not educated; but Ph.D.'s in history, government, economics, philosophy, or fine arts are? Such a neat classification is surely unsound. Does education inhere in certain subject matter and not in others? It clearly does not. Education derives only from a certain attitude toward knowledge – the attitude of the educated man.

We have too often assumed that the technician is to be found only among the scientists and engineers. But the technician exists in all fields of knowledge, and he is nowhere more to be deplored than in the humanities, where his thinking can be far more rigid and restricted, his research and teaching quite as lacking in meaning and perspective as those of the technician in science or engineering. Yet we must also recognize that those educated principally in the humanities seldom know of the sense of discovery in experimental science, the aesthetic experience possible in higher mathematics, or the intellectual achievement of a sound engineering design.

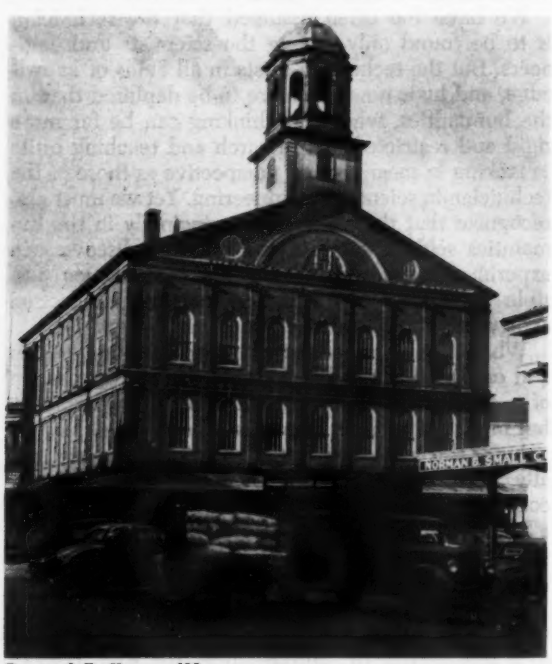
What then is an educated man? The universities and engineering schools are agog with this question of a proper education for scientists and engineers, but much noise arises from a lack of any clear philosophy of this sort of education. The problem has usually been simply avoided by introducing "cultural courses," with varying degrees of organization and effectiveness within themselves, in the rather desperate hope that exposure to a few subjects assumed to be cultural will somehow produce educated men. Unfortunately, both faculty and students have an uneasy sense that such programs have resulted only in a thin veneer of "culture" over the solid core of science and engineering.

Our basic need is a philosophy of education which will integrate the entire training of our scientists and engineers – to produce the educated scientist or engineer.

What then is an educated scientist or engineer? Does he differ fundamentally from any other educated man? In so far as he is a scientist or an engi-

neer, one may say that he has obvious differences. In so far as he is an educated man, the differences are of little importance. We may make a distinction fundamental to our problem. The distinction is that between the technician and the educated man, between one who knows and one who understands what he knows.

This distinction is not always kept clearly in mind. It does not at all turn on the subject matter of a man's education. There are technicians in English literature, in history, even, I am sorry to say, in the history of science. There are educated physicists, chemists, biologists, and engineers. The technician then is the man who has amassed a large body of knowledge, or who has acquired a highly developed special skill, but who does not see beyond it. He has no conception of what it all means, and worse, he often does not care whether it means anything. He does not know what relation his studies bear to other fields of thought, nor is he interested in the place of his own work in man's knowledge as a whole. He may be seen at his best in Robert Browning's poem *A Grammarian's Funeral*, and at his worst in monographs in which at least three-quarters of each page is taken up with footnotes. I have purposely pictured him in the so-called "cultural studies," for he is not there so well recognized. We tend to assume that *literae humaniores* are actually humane. Among scientists and engineers the technician is more frequently found. Two of many typical expressions which the scientific technician uses to indicate the results of his education are: "Oh, poetry and all that are well enough, but . . ."; or "Pure metaphysical speculation."



Raymond E. Hanson, '03

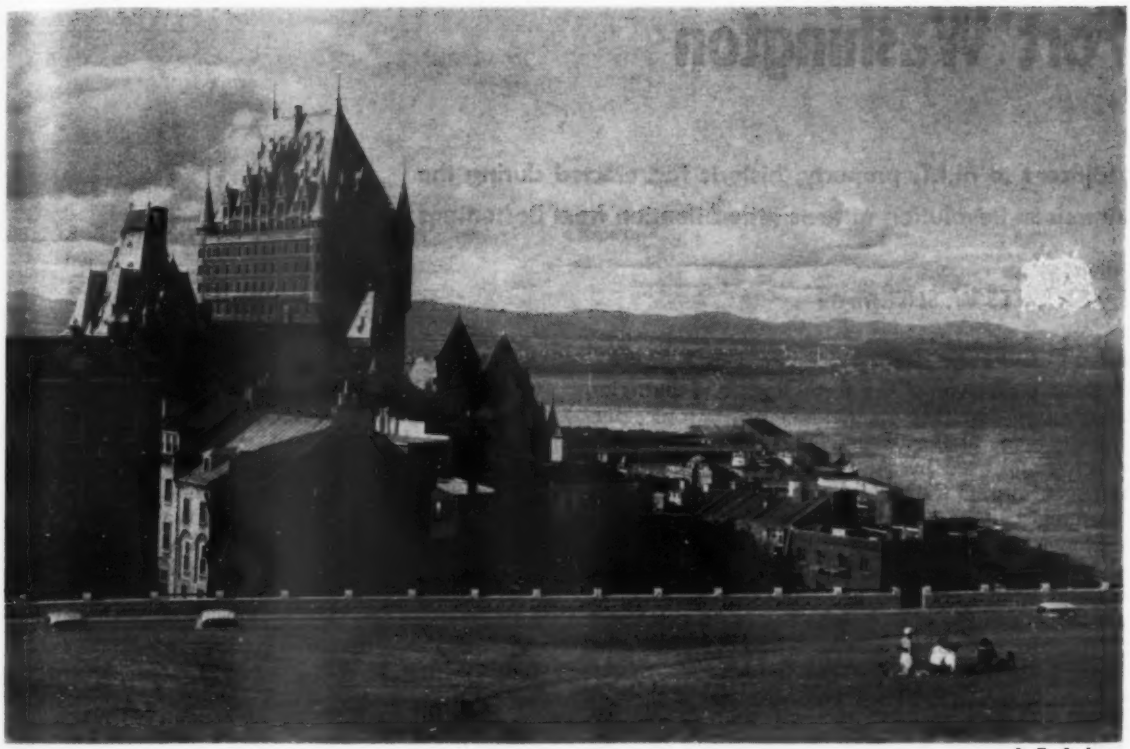
The mark of an educated scientist or engineer would appear to be a good training in the fundamentals of science or engineering, a knowledge of the history of their specialty together with something about its philosophy, and a fairly clear idea of its historical relation with the rest of society and of man's thought. What better symbolism of this thought than this view of Boston's historic Faneuil Hall, whose present market operations are simultaneously facilitated and obstructed by transportation methods due to technology?

During the 1870's and 1880's Sir Michael Foster, Thomas Henry Huxley, and John Tyndall fought to establish science in the English system of education as being "an intellectual training fitted for all sorts and conditions of men." That battle was fought and won. Science took its place alongside the "cultural studies" as an integral part of the curriculum. It has sometimes, however, come to take too large a place, and the day is not far off when it will become necessary for *literae humaniores* to fight for their academic lives. This situation is especially bad in engineering and scientific schools, some of the largest of which make no effort whatever to acquaint their students with anything other than pure and applied science. But, as pointed out above, the problem is not primarily one of subject matter; rather it is one of attitude – the attitude of the educated man.

The educated man is possessed of a certain body of knowledge – in Matthew Arnold's phrase, he knows "the best that is known and thought in the world." He knows what it means, he recognizes the interrelations of its parts and its relation to the whole body of man's knowledge. Arnold set too high an ideal for our knowledge; there is too much good thinking in the world for us to know it all. But it is possible to attain this ideal in one field of thought at least. For the engineer or scientist it is possible to have an exact and full knowledge of his subject, to have some notion of its meaning, and to realize its place in the whole of knowledge and life. It is not only possible, it is necessary. In the announcement of Ostwald's *Klassiker der Exakten Wissenschaften* is the following significant statement: "While, by the present methods of teaching, a knowledge of science in its present state of advancement is imparted very successfully, eminent and farsighted men have repeatedly been obliged to point out a defect which too often attaches to the present scientific education of our youth. It is the absence of the historical sense and the want of knowledge of the great researches upon which the edifice of science rests."

It has recently been pointed out that within the sphere of their particular work our physicists have become so specialized – so unacquainted even with classical physics – that their scientific research is found wanting. Have they not also thus neglected the educational opportunities inherent in their own field of knowledge? It seems to me to be the function of an engineering or scientific school to produce educated scientists and educated engineers free of these faults. Its graduates should have a good training in the fundamentals of science or engineering, a knowledge of the history of their subject and something of its philosophy, and also a fairly clear idea of its present and its historical relations with the rest of society and of man's thought. The history of science and the history of engineering offer a way to attain this very end.

The history of science can have two functions in an education: it may give background and depth to the student, and it may serve as a bridge to other cultural subjects. Through a study of the history of



J. R. Jackman

The educated man understands what his knowledge means and recognizes the interrelation of its parts. Clearly, education derives from an attitude toward learning rather than from the particular subject matter studied. True education can be developed through science, engineering, and architecture as readily as through the liberal arts.

science the student attains a new understanding of scientific advance. He discovers that science was not handed down like the Ten Commandments, but is rather the result of long and patient work by hundreds of men slowly advancing. He learns from the lives of the great scientists that science was created by men and not by gods. The subject matter then becomes to him merely one stage in a tremendous sweep of unfolding knowledge of nature and man.

Co-ordinated with some small research of his own, the history of science will give the student a far deeper conception of what science really is than will any textbook or the routine laboratory work common in most elementary courses. His understanding of science is also deepened by the discovery that some of the greatest figures in science were wrong. A study of the phlogiston theory cannot but make him skeptical of the results of modern science. If men such as Priestley and Cavendish could believe in phlogiston, when today it seems almost ridiculous, may not our own knowledge some day appear equally foolish? In accepting this precept, the student has then taken the first step that leads to fundamental research – he has begun to doubt. This is of the very essence of scientific progress. If he reads also of Black's subsequent acceptance of Lavoisier's demolition of the phlogiston theory, he has also learned something of the true nature of science. This aspect of the teaching of the history of science meets the demand that the educated scientist or engineer should have some understanding of the meaning of his subject. Its history brings out the real meaning of scientific advance. What about its philosophy?

If the history of science is only to record each advance or retrogression as it is made, and how it came to be made, the history of science becomes not history, but merely a chronicle. The very essence of the history of science is the development of scientific method and the scientific vocabulary. Given the whole of modern scientific methods for the study of nature and none of the facts, we could probably recover the whole body of science in a generation. Witness the 30 years after Galileo and Descartes. The body of knowledge is important, but the way of thinking is more so. Lavoisier's great discoveries were of far less importance than the methods which he used to find them. His revision of chemical nomenclature might be said to be more important still. The long story from the Ionian "water," "nous," or "apeiron" to the exact language of modern physics and chemistry cannot fail to bring to the student's mind the great significance of exactness of expression in science. In brief, the history of science can do something to the student's mind more than merely pour information into it. The study of the history of engineering can have a similar educating effect on the minds of our young engineers.

The other characteristic of the educated scientist or engineer – his recognition of the relations of his world with other worlds of ideas and with the world of man himself – can also be found in the history of

(*Continued on page 154*)

Fort Washington

Adjacent to M.I.T. property, historic fort erected during the American Revolution attracts little attention from Bostonians

by CHARLES W. SHERMAN

THE sole survivor of the forts, lines, and batteries, constructed by either American or British forces during the Siege of Boston in 1775–1776, or previously existing and used by the British, is the little "half-moon battery" in Cambridgeport, now known as Fort Washington. It is, therefore, a monument of real significance to persons interested in the events of the first year of the American Revolution. Yet few people of Greater Boston, or even of Cambridge, know of its existence, and the number who have seen it is small.

Whoever has visited the North End of Boston must have been impressed by the intimate knowledge which children of that section have about the Old North Church, the Paul Revere House, and Copp's Hill. By contrast, the lack of knowledge of Cambridge's historic relic by Cambridge people, and especially by the school children who live in the vicinity, and who, at least to some extent, see it almost daily, is difficult to understand.

The name, Fort Washington, was given to the little earthwork in 1858, shortly after the land upon which it stands was donated to the city of Cambridge. It was then enclosed by an elaborate iron fence, of which only a part remains undamaged, and three 18-pounder cannon were obtained from the old Fort Warren in Boston Harbor (which was being dismantled by the Army and replaced by the new Fort Warren on George's Island), and were placed in the embrasures or openings in the embankment, to give it the appearance of a real fort.

Fort Washington is located on Waverly Street, at the foot of Allston Street; its location, with respect to M.I.T. property for athletic and recreational use, is shown in Fig. 1. It borders on the tracks of the Boston and Albany Railroad, and is near the large sign of Cain's mayonnaise, which fronts on Vassar Street and is easily seen from Memorial Drive. A "Plan of Washington Square," prepared by the City Engineer, and furnished by City Manager John B. Atkinson, is the basis for the sketch shown in Fig. 3, and a photograph of the works, from within the enbankment, is shown in Fig. 2.

In his report to the Continental Congress dated November 28, 1775, General Washington wrote:

"I have caused two half-moon batteries to be thrown up, for occasional use, between Lechmere's Point and the mouth of Cambridge River, and another work at the Causey (causeway) going to Lechmere's Point, to command that pass, and rake the little rivulet that runs by it to Patterson's Fort. Besides these, I have . . . marked out three places between Sewall's Point and our lines on Roxbury Neck, for works to be thrown up, and occasionally manned, in case of a sortie when the bay gets froze."

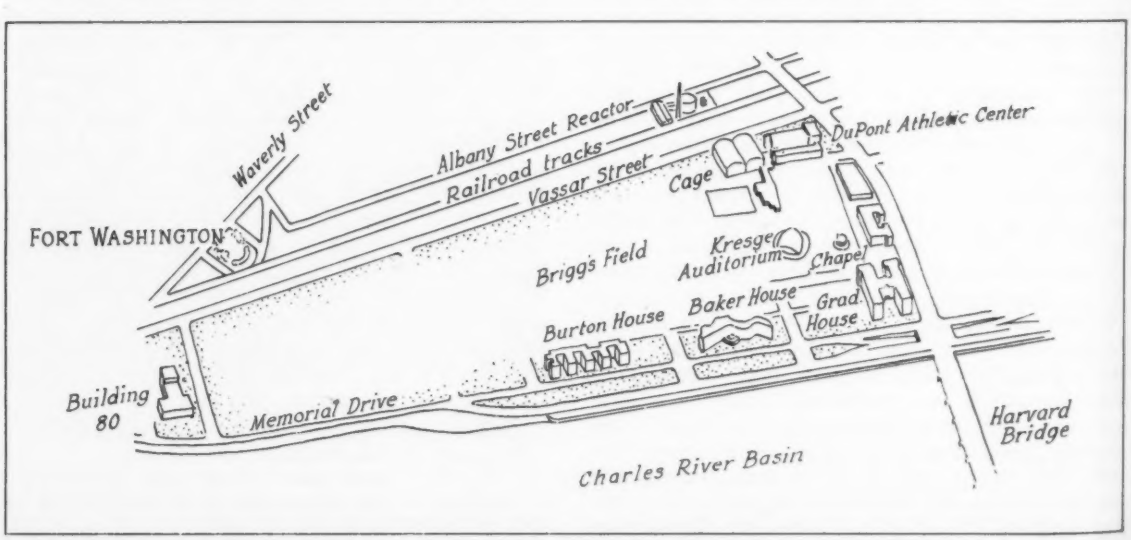


Fig. 1. Map of the Institute's recreational and living area west of Massachusetts Avenue, showing location of Fort Washington on Waverly Street in Cambridge.

Raymond E. Hanson, '03

Fig. 2. (Above) *Fort Washington, from behind embrasures, as it appears today.*

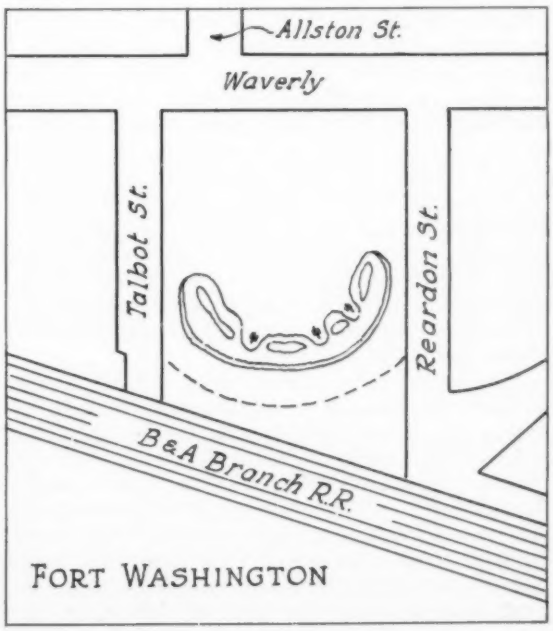
All of these works were, as Washington wrote, primarily for occupancy as defensive points in case of an assault by the British; but as, at that time, he was planning the immediate construction of a much more considerable fortification at Lechmere's Point (which soon became the most important offensive post in the American lines) and as he certainly must have had in mind the fortifications on Dorchester Heights, which were thrown up in March, 1776, it seems altogether probable that the major reason for building these minor works was to accustom the troops to throwing up earthworks, and to cultivate a feeling that such works were of real importance.

As shown in Fig. 3, the earthwork is nearly equivalent to half of a circle, having a diameter of about 120 feet, the length of the embankment being about 200 feet. It is likely that it was intended to be occupied by one company of troops, or some 50 or 60 men.

The three openings were doubtless intended for use by field pieces, three or four pounders, which would probably have been drawn by hand from the camp across the marsh. The embankment is only about three and a half feet high at one end, and five feet at the other; but these little "half-moon batteries" and other minor works are shown on the excellent map of Henry Pelham, made for the British in 1775 and 1776, and may well have been assumed by them as of much greater importance than was actually the case.

At the time these little fortifications were constructed, Knox was on his way to Ticonderoga, to get the best of the cannon which were there and at Crown Point, and it was essential that the troops be trained

Fig. 3. (Below) *Diagram showing plans of Fort Washington. Earthwork is about equivalent to half a circle, with a diameter of around 120 feet; length of embankment about 200 feet.*



Raymond E. Hanson, '03

Fig. 4. Close-up of one of the three cannons showing details of cast-iron gun carriage. Toward rear is iron fence with simulated cannon as posts.

in constructing works in which the guns could be mounted promptly when they were received.

The best statement about the transfer to the city of the Fort Washington property seems to be that contained in the *Historic Guide to Cambridge*, compiled by members of Hannah Winthrop Chapter, Daughters of the American Revolution, in 1907, on page 179. It is as follows:

"The three gun battery at the foot of Allston Street retains the semblance of a fort, and is called Fort Washington. The land where this battery was thrown up had been held in common from the close of the Revolution till 1857, when it was deeded to the city by the following persons: Edmund T. and Elizabeth Hastings, Mary E. Dana, Joseph A. and Penelope Willard, John and Hannah B. Bartlett. A fund of $800 was also turned over to the city, by these people who cared for this plot of historic land. The conditions named in the deed were as follows: 'that the above premises when suitably enclosed and adorned by said city, shall forever remain open for light, air, and adornment, for the convenience and accommodation of the owners of estates in said Pine Grove and of the Public generally.'

"The city accepted this gift and with the assistance of the commonwealth of Massachusetts proceeded to restore this battery to its original condition, to build a substantial fence around it and to erect a flag-staff. The Secretary of War gave three thirty-pounder guns, and the Secretary of the Navy gave the gun carriages. The state legislature voted to appropriate the sum of $2000, 'provided the city of Cambridge shall appropriate a sum sufficient to complete the said fence at a cost of not less than four-thousand dollars, and said Fort Washington shall always be accessible to the public, and that said city of Cambridge shall always keep the fence proposed to be built, in good repair.'"

The guns standing in the embrasures are actually 18-pounders. They were among those over-age cannon which were removed from the original Fort Warren, on Governor's Island, when a new Fort Warren was built on George's Island. Marcus Morton, of Cambridge, learned by correspondence with the Historical Section of the Chief of Ordnance in Washington, in 1942, that the guns were cast by the West Point Foundry, on Hudson River; and he discovered in the city records that it cost the city the sum of $13.50 to bring these guns from Governor's Island to Cambridge!

Of course guns of this size would never have been placed by Washington at this insignificant earthwork, even if the Americans had had enough large cannon. These particular guns are, therefore, out of place in any such work as this little "half-moon battery"; but as they have now been there for about 100 years, and as they were presumably given to the city with the understanding that they were to be kept there, it would be inappropriate to remove them. Besides, smaller pieces would probably have been "borrowed" from such an open space long before this time.

These cannon are identical, except for the numbers and weights marked upon them. They are numbered 45, 36, and 40; and their weights are shown as 30-0-13, 30-0-17, and 30-0-16, respectively (in hundredweight, quadrants, and pounds). These figures correspond to 3,373, 3,377, and 3,376 pounds. The bore is approximately 5⅝ inches; the diameter of an 18-pound sphere of cast iron is 5.1 inches; the excess diameter of the bore (called windage) was usually about ¼ inch, or a little more, to allow for irregularities in the bore of the guns and the casting of the balls. The next larger standard size for cannon of that period was 24 pounds, which would require a bore of at least 5.9 inches.

The photograph in Fig. 4 also shows the cast iron carriage of one of these guns in considerable detail.

The fence surrounding Fort Washington Park is somewhat elaborate, evidently with the object of giving a monumental appearance to the earthwork which it enclosed. The gateposts are of granite, with cannon in bas-relief on the outer faces, and each bears beneath the cap a bronze plate. The inscriptions on these plates are as follows:

On the left-hand post —

This fort was used during the
Siege of Boston
and helped force its
Evacuation by the British

On the right-hand post —

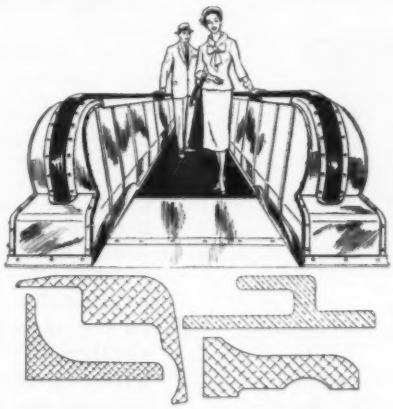
FORT WASHINGTON
constructed November 1775
by the
Continental Army under
General George Washington

The fence is of iron, with simulated cannon as posts, and alternate spears and halberds as pickets. A considerable part of it has been damaged, perhaps maliciously, as there seems to be no other explanation for the many broken parts.

BUSINESS IN MOTION

To our Colleagues in American Business . . .

At the new $7,000,000.00 Love Field air terminal, Dallas, Texas, travelers are transported to and from the terminal building to the loading fingers via the world's longest passenger conveyor system. In fact this "moving sidewalk" is the first installed at an airport anywhere in the world. In operation since last January, it has already met with a high degree of public acceptance.



As you step on this "moving sidewalk" you will notice the broad use of aluminum extrusions. They are used as floor cove molding, handrail molding, spoon molding between balustrades and rubber carpet, and as a wall cove between handrail and wall. All told 22,000 lbs. of Revere Extruded Aluminum Shapes are used. Not only are these Revere Aluminum extrusions attractive and decorative but their satiny finish will remain so for years with an occasional soap and water cleaning the only maintenance required.

Hidden under the moving rail is the track made from 22,000 lbs. of Revere Extruded Bronze Shapes, fabricated to close tolerances and micro-finished, taking constant daily rugged wear in its stride.

The selection of Revere Aluminum and Bronze Extrusions was not a mere matter of specification. It was the result of HEWITT-ROBINS Engineers and Designers consulting with Revere's Technical Advisory Service men in order to determine the alloys and the shapes best suited to meet the particular requirements of this installation. It is instances such as this, multiplied by hundreds of times, that qualifies Revere's Technical Advisory Service to aid in the impartial recommendation of the right metal — be it copper, copper-base alloys, aluminum alloys, welded steel tubing or other metals and alloys — to do the best possible job at the least cost. And so it is with practically every industry you can name. When you take your supplier into your confidence, discuss your problems with him, you invariably are rewarded with a better product at less cost, because the material finally selected is the *exact* material for the best job.

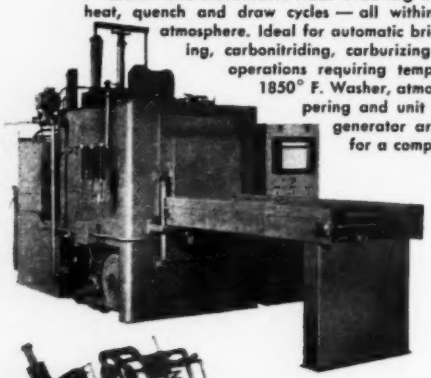
REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: **230 Park Avenue, New York 17, N. Y.**

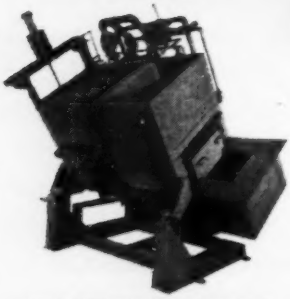
HEVI DUTY

IN STEP
with tomorrow's
stepped-up
DEMANDS

INDUSTRIAL FURNACES

Clean-line Automatic Heat Treating Unit handles heat, quench and draw cycles — all within protective atmosphere. Ideal for automatic bright hardening, carbonitriding, carburizing and other operations requiring temperatures to 1850° F. Washer, atmosphere tempering and unit atmosphere generator are available for a complete system.





Fuel-Fired Melting Furnaces — rigid or tilting types, manual or power-operated. Included are crucible furnaces and dry hearth furnaces for melting aluminum and other soft metals.

Vertical Retort Furnaces — Removable, sealed retorts make it possible to slow-cool a charge within protective atmosphere while a second retort load is being heated. Widely used for carburizing, nitriding and many other heat-treating processes.

HEVI-DUTY ELECTRIC COMPANY

MILWAUKEE 1, WISCONSIN

- Industrial Furnaces, electric and fuel
- Dry Type Transformers
- Constant Current Regulators

SCIENCE, ENGINEERING, AND THE HUMANITIES

(*Continued from page 149*)

science and in the history of engineering. Most engineering and scientific students have built up in preparatory school a considerable resistance to history, literature, or any of the so-called cultural subjects. They do, however, have a very keen interest in science, mathematics, or engineering.

Through the study of the history of science, this interest can be led into an interest in philosophy, especially logic and scientific method; into intellectual history, of which the history of science is a most important part; and so into general history. Courses in the history of engineering cannot omit questions of economic history, economics itself, labor problems, and general social questions. Briefly, both these subjects inevitably open out into so many others that the student's original interest in science leads him to new interests, or at least to a recognition that science and engineering are but part of a whole. He sees his own knowledge in relation to other studies and to that whole. The study of the history of pure and applied science can, then, help in making the scientist or engineer something more than a technician, and will of necessity aid in making him an educated man.

Such a program of studies can do even more; it can make our student a better scientist or engineer. Nearly 100 years ago James Clerk Maxwell wrote:

> Such indeed is the respect paid to science that the most absurd opinions may become current provided they are expressed in language the sound of which recalls some well-known scientific phrase. If society is thus prepared to receive all kinds of scientific doctrines it is our part to provide for the diffusion and cultivation not only of true scientific principles but of a spirit of sound criticism.

If Maxwell's view still be true, and I believe it to be even more cogent today than when he wrote, we can then ask: "How is the scientist or engineer to interpret to society as a whole what he is doing, if he does not see his work in historical perspective, as part of a whole – a unity which is our heritage?"

But how, as a practical matter, is all this to be brought about? There are numerous courses in the history of science, and a few in the history of engineering, in the colleges of the United States; and they are, with very few exceptions, all equally bad, principally because they nearly all are taught by men who are not themselves educated in the sense indicated above. This situation arises from the common fallacy that a good scientist is necessarily a good historian of science. These courses may appear almost anywhere – in departments of history, science, engineering, economics, or philosophy. One thing they have in common – the men teaching them are seldom really qualified to do so.* A number of these men are fitted to teach the history of a particular science, but no one seems to have recognized that the introductory or survey course demands a far deeper and broader training than almost any other course in the university. Such a teacher should have a sound knowledge of astronomy, physics, chemistry,

(*Concluded on page 156*)

* The author has taught both subjects and includes himself!

Microwave delay line for use in airborne equipment

MICROWAVE RESEARCH

The expanding role of electronic equipment in modern military operations has given high priority to microwave research. No field today offers greater challenge to the scientist and engineer.

In support of current electronic countermeasures programs and in anticipation of future systems requirements, Ramo-Wooldridge Division is engaged in microwave research to develop new techniques and to refine conventional components.

Research is under way at Ramo-Wooldridge for new methods and new designs to reduce substantially the over-all size, weight and complexity of electronic equipment for both airborne and ground-based uses.

For example, the low-loss delay line in the photograph above was designed, developed and manufactured by Ramo-Wooldridge for use in airborne equipment. Packaged for use in the system for which it was designed, this miniature ceramic unit weighs less than two pounds. It replaces a component which weighed more than twenty pounds and occupied more than five times as much volume.

Special opportunities exist for those with qualified experience in microwave research—in technique evaluation, component development, and design of such systems equipment—at Ramo-Wooldridge.

Engineers and scientists are invited to explore openings at Ramo-Wooldridge in:

Electronic Reconnaissance and Countermeasure Systems
Infrared Systems
Analog and Digital Computers
Air Navigation and Traffic Control
Antisubmarine Warfare
Electronic Language Translation
Information Processing Systems
Advanced Radio and Wireline Communications
Missile Electronics Systems

RAMO-WOOLDRIDGE

P.O. BOX 90534 AIRPORT STATION • LOS ANGELES 45, CALIFORNIA

a division of *Thompson Ramo Wooldridge Inc.*

GEARS

Made to Your Specifications

You and we can form a team—you to draw up the specifications; we to make the gears—that will be profitable to both of us. Gears of all types, all sizes, all materials. Design-engineering service available.

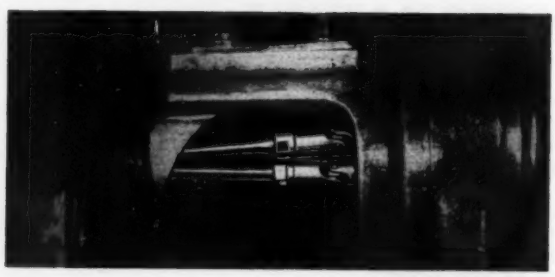
Custom Gears Exclusively

DIEFENDORF GEAR CORPORATION

Syracuse 1, N. Y.

DIEFENDORF GEARS

Solving a breakage problem AT CLOSE QUARTERS



The manufacturer of this button-drilling machine had a tough problem: the universal joints on these parallel shafts carried such a torque load there were frequent complaints of breakage . . . yet the close centers prohibited use of a larger joint. **The solution** was a Curtis Universal Joint of the same size but higher torque.

This is only one of many problems solved by Curtis Joints — size for size the strongest universal joints designed for industry. Selected materials, precision engineering, and over 30 years' experience manufacturing universal joints make them that way.

14 SIZES ALWAYS IN STOCK
3/8" to 4" O.D.
(6" joints on special order)

Not sold through distributors. Write direct for free engineering data and price list.

TRADE MARK **CURTIS**
UNIVERSAL JOINT CO., INC.
8 Birnie Avenue, Springfield, Mass.
As near to you as your telephone

EXCLUSIVELY A MANUFACTURER OF UNIVERSAL JOINTS SINCE 1915

SCIENCE, ENGINEERING, AND THE HUMANITIES

(*Concluded from page 154*)

and mathematics; some knowledge of biology, medicine, and engineering; a good foundation in philosophy, especially in logic and scientific method; a thorough knowledge of world history, especially intellectual history and the history of religion; and this is only background. All this seems impossible, yet must be striven for.

Merely introducing courses in the history of science and engineering is not enough. These are fairly common, and do not achieve the aims suggested above. Courses in history, in philosophy, or in literature are fairly frequent in most engineering and scientific schools, but it is amazing to see how well the student can do in them and manage to keep them in watertight compartments completely separated from the rest of his studies. It is definitely a mistake to assume that, because a man has been exposed to economics, to history, to literature, to philosophy, or to the fine arts, he is therefore an educated man. The courses which are aimed at educating the student must be closely co-ordinated with those which train him technically. It is not sufficient that his cultural courses form a coherent whole in themselves. It is necessary that his entire training form a consistent whole aimed at producing the educated scientist or engineer. There is no field of study which is as convenient as is the history of pure and applied science for effecting this unification.

At M.I.T. we have taken some of the first steps towards achieving this goal, but the work is by no means complete and its results are very difficult to evaluate. These courses are almost entirely elective; a student may choose a series of such integrated courses but is not required to follow any such unified program unless he so desires.†

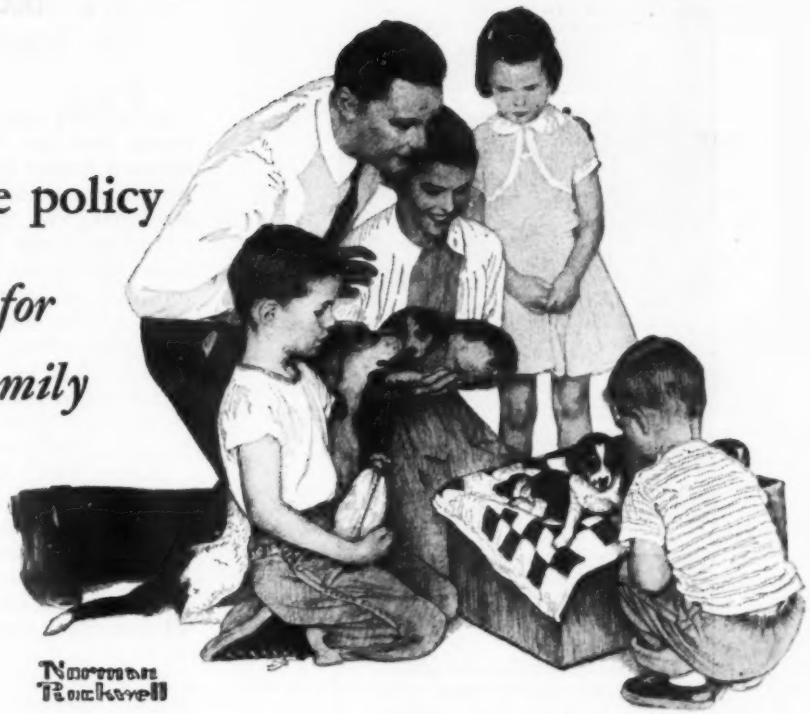
The aim of all these courses must not be the minutiae of the history of the subject, nor a catalogue of discoveries, but rather to give the student something of the history of his subject, perspective on modern science, a deeper realization of the debt which he owes to the pioneers, and some understanding of the great movements in the development of science — in short, to educate him within the framework of his principal studies.

The study of the M.I.T. courses in History and Philosophy of Science, or of the History of Engineering and Economic History, will not alone make our students educated scientists and engineers. They need also to be offered literature, music, fine arts, political and social history, ethics, even metaphysics! But the history and philosophy of their own special interests do form the most convenient and logical bridge to an integrated education. Their study, however, must not become merely scholarly pursuits for a devoted few; they must perform an equally important function as a vital and unifying force in the education, not only of the scientist and engineer, but of every educated man. To do otherwise is to court the disaster that is inevitable if the study of Nature is cut off from the study of Man.

† The scientific and engineering training is of course within itself very carefully and closely integrated.

Now in a single policy

Life Insurance for the Whole Family



Massachusetts Mutual's new Family Plan combines in an economical all-in-one policy, life insurance for Dad, Mother and the children. And it automatically covers, *at no extra cost,* children born or legally adopted later.

It covers you, Dad. You receive permanent life insurance with regular cash and loan values. Should anything happen to you, your family will receive the amount of your protection. In addition, the insurance on your wife and children will continue as originally planned, *without further premium payments.*

It covers your wife. She receives insurance up to half the amount on your own life, $10,000 maximum, continuing to the age you select.

It covers your children. Each child from 6 months to 18 years old is insured until age 25 for half of your wife's coverage, up to $5,000. Babies from 14 days until 6 months of age are covered for lesser amounts. As each child reaches 25, he can take an individual policy for as much as five times the Family Plan insurance on his life . . . regardless of his health at the time. This can be important.

New Convenience. Just one premium payment will cover your whole family's insurance . . . makes keeping records so easy. And this new Family Plan is economical, too — gives you all-in-one protection at a low premium rate. Ask your Massachusetts Mutual man about it. Or call our General Agent listed under Massachusetts Mutual in your phone book.

Massachusetts Mutual

LIFE INSURANCE COMPANY

ORGANIZED 1851 SPRINGFIELD, MASSACHUSETTS

Some of the Eastern Group alumni in Massachusetts Mutual service:

LAFAYETTE

David B. Adler, '17, Jacksonville
M. Holmes Shoemaker, '18, Binghamton
David K. Aldrich, '38, Wilkes-Barre
Frank W. Hiller, '43, Home Office
Benjamin C. Youngman, '44, Pittsburgh

LEHIGH

Wilbur R. Heck, '20, Philadelphia
Russell E. Hoaster, '31, San Antonio
Edward Billstein, Jr., '40, Atlanta
R. Lester Dodson, Jr., '44, New York

M. I. T.

Lyman L. Tremaine, '23, New York
Harold G. Ingraham, Jr., '49, Home Office

U. OF N. H.

Ward N. Boylston, '25, Barre
Ernest W. Furnans, Jr., '37, Home Office
Roger B. Gould, '50, Home Office
Richard W. Vogel, '51, Cleveland
Willard Jones, '54, Home Office
Gerald E. Doten, '55, Home Office
Victor Cardosi, '58, Home Office

PENN STATE

Rudolph G. Kraft, '18, Home Office
Donald M. Wieland, '19, Wilkes-Barre
Thomas H. Levering, '25, Wilkes-Barre
John L. Macdonald, '28, Wilkes-Barre
Charles P. Kennedy, '32, Chicago
W. Corkran Darlington, '39, Philadelphia
Sylvan S. Taub, '53, Philadelphia
Kenneth C. Kramer, '54, Wilkes-Barre
Elizabeth A. Chassey, '55, Home Office
Lawrence F. Hill, Buffalo

ENGINEERS
PHYSICISTS
MATHEMATICIANS

Douglas diversification affords broadened opportunities, combined with stability and security.

Engineering at Douglas is divided into three basic areas ... missile and space systems, transport aircraft and combat aircraft. In these military *and commercial* categories, each advancing beyond present frontiers of achievement, engineers and scientists can progress to the limit of their capabilities.

In addition, supervisory and executive openings are filled from within the company. Many of the top executive officers at Douglas are engineers who have moved right up to assume wide responsibility.

We are interested in engineers with backgrounds in other fields as well as avionics, aircraft and missiles.

For further information write to Mr. C. C. LaVene, Douglas Aircraft Company, Inc., Santa Monica, California.
Section N.

the most respected name in aircraft, missile and space technology

DECADE IN REVIEW

(Continued from page 146)

In his 1951 annual report, President Killian could record that the Riverside Apartment Hotel (now renamed Burton House) had been reconverted into a student dormitory. A substantial office building on Memorial Drive, near Kendall Square, and formerly owned by Lever Brothers, was purchased in 1951 with a grant from Alfred P. Sloan, Jr., '95. This structure now houses the School of Industrial Management, and has been renamed the Sloan Building.

As a grant from the Kresge Foundation assured its success, plans for a much-needed auditorium were completed in 1952. In May, 1952, the Faculty Club on the sixth floor of the Sloan Building came into being as a social center for the Institute's family.

During 1952, the Metals Processing Laboratory was put into operation. The Department of Biology and the Department of Food Technology were transferred to the recently completed Dorrance Laboratories. This move permitted the Department of Electrical Engineering to expand its offices and laboratories to the third and fourth floors of Building 10.

To honor Professor Charles M. Spofford, '93, Head of the Department of Civil Engineering from 1911-1933, the Charles M. Spofford Room was dedicated on December 7, 1953. The room serves students as a modern and well-appointed meeting place for social and educational gatherings.

A year later, a seminar and social room for student activities in the Department of Mechanical Engineering was dedicated on December 18, 1954. The room is known as the Edward F. Miller Room, in honor of Professor Miller, '86, who was head of the Department of Mechanical Engineering from 1912-1933.

The Kresge Auditorium and the M.I.T. Chapel were dedicated on May 8, 1955, in impressive ceremonies. Both buildings are of unusual design and still cause comment from those who see them for the first time. A magnificent private mansion in Dedham, known as Endicott House, was presented to the Institute in 1955 and has since been used for conferences, symposia, and study projects requiring an invigorating and secluded environment.

As recorded in the July, 1957, issue of The Review, the Karl Taylor Compton Laboratories were dedicated on Alumni Day, 1957, at which time construction of the nuclear reactor was reported to be well along. During 1957, the Institute purchased the National Guard Armory on Massachusetts Avenue opposite its main educational structures. The will of David F. du Pont, '56 (whose untimely death occurred in September, 1955), made it possible for the first time for the Institute to plan an adequate athletic center which is currently being erected, adjoining the National Guard Armory. Long overdue, gradual demolition of Westgate – a temporary housing project for married students erected shortly after the end of World War II – was begun in the fall of 1957. The most recent building to be added to the Institute's property is a four-story residence building

(Continued on page 160)

NEW REFERENCE BROCHURES NOW READY!

This series of new four-page bulletins has been planned to assist the engineer in determining the proper wire for particular applications, and to help in writing specifications. These brochures are entitled:

Flexible, 1000° F & 750° F Wire & Cable — Super Jet and Saturated Super Jet — Lead Wire, Hook-up Wire, Coaxial Cable, Multiconductor Cable, Ignition Wire.

High Performance Cable — Small-diameter, single conductor for special high-voltage, high-temperature applications.

Single and Multi-Conductor Cable — with Silicone Rubber Insulation.

TV Camera Cable — Microwave Relay-Link Cable.

Multiconductors to MIL-C-3432A — Flexible and Extra Flexible Low Temperature Constructions.

We shall be glad to send one or all, and to put your name on our mailing list to receive additional new bulletins as they are issued. Write to us regarding your wire problems.

BOSTON INSULATED WIRE AND CABLE CO., BOSTON 25, MASS.

Need corrugated boxes in volume?

See your H&D packaging engineer

HINDE & DAUCH

Division of West Virginia Pulp and Paper Company

15 Factories, 42 Sales Offices

Sandusky, Ohio

310 FOOT TOWER

BRINGS WEATHER DATA DOWN TO EARTH

Sturdy Trylon Towers such as this help micrometeorology play an increasingly important role in air pollution control for modern industry.

This typical installation—for New York University's College of Engineering—aided the design and adjustment of smoke stacks for Consolidated Edison's new atomic- and oil-powered generating station. The rigidly-braced tower supports seven resistance thermometers and three Bendix-Friez Aerovanes on retractible arms. Special platforms at each location allow safe inspection of all equipment. Also included is a smoke generator which can be raised to various heights for comprehensive air current studies. The tower and accessories are hot-dip galvanized for maximum corrosion resistance.

As specialists in out-of-the-ordinary towers for over 20 years, Trylon welcomes the opportunity to quote on your next tower requirement—on the design, fabrication, installation or supervision of the entire system or of any component.

TRYLON® TOWERS

Trylon Towers are made only by:

THE WIND TURBINE COMPANY, West Chester, Pa.

ROBERT W. WEEKS '13, PETER G. PARK '40

In Canada: The Wind Turbine Company of Canada, Ltd., Toronto 9, Ontario

DECADE IN REVIEW

(*Continued from page 158*)

on Memorial Drive which has been converted into quiet and dignified quarters for the Institute's religious counselors.

Housing

As the Institute grew, its student body found increasing difficulty in locating suitable living quarters on or near the campus, and its Faculty and staff tended to move to areas remote from the Great Court. Furthermore, the composition of the student body was changing. In recent years something like 10 per cent of the student body has come from foreign countries (9.6 per cent in 1953 and 11.9 per cent in 1957). Since the end of World War II, married students have constituted a goodly percentage of the total student body. At the beginning of the current (1958-1959) school year, 190 of the 3,587 undergraduates, or 5.3 per cent, were married students. Of the 2,672 graduate students, 1,186, or 44.5 per cent, were married. For the total student body of 6,259 students, 1,376 or 22 per cent were married. For quite a few years, the number of women students has exceeded 100, most of whom are enrolled in the Graduate School. As efforts were made to transform M.I.T. into a residential college, it became clear that housing had become a major problem – as automobile parking still is.

In the field of housing, in 1948-1949 construction was begun on the Eastgate Apartment. A score or more of members of the Faculty and Administration live in this building on Memorial Drive, just east of, and adjacent to, the President's House. The serpentine Baker House – a dormitory for approximately 350 students – was dedicated on June 11, 1949. Construction of this building was aided by a gift of $500,000 from the Alumni Association. The Faculty residence plan, in which a member of the Faculty took up residence among students in one of the dormitories, was initiated in 1950 in Baker House but was soon extended to Burton House and the East Campus.

Beginning in September, 1952, freshmen were required to live in M.I.T. dormitories, if they did not reside at home or in fraternity houses.

By 1955, it was evident that M.I.T. dormitories would again soon be inadequate for student needs.

William H. Coburn & Co.

INVESTMENT COUNSEL

68 Devonshire Street

Boston

Accordingly, a comprehensive study of student housing was made under the chairmanship of Edwin D. Ryer, '20. This study resulted in improvements and modifications in existing dormitory buildings. More important, however, the study established a plan for future long-range housing at M.I.T.

In 1956-1957, as the distaff student body continued to grow, a portion of Bexley Hall was renovated and set aside for women students, not all of whom could be accommodated in the Residence for Women on Bay State Road in Boston. Also, in 1957, Frederick G. Fassett, Jr., was made Dean of Residence and moved into a splendid mansion on Memorial Drive where he and Mrs. Fassett are able to enhance a homelike environment for students in a metropolitan university. This fine residence first became available to M.I.T. in 1951 through a grant of the Moore estate.

Public Relations and Regional Conferences

As M.I.T. activities have spread into many areas not formerly regarded as part of the program of an academic institution, the Administration has found it desirable to expand and enhance its relations with the public, as well as with its loyal and rapidly growing alumni body.

In 1945 the News Service employed one man and one girl. It was then primarily engaged in serving as liaison between the Institute and the daily press, and in interpreting newsworthy topics on science and engineering. Today, its successor, the Public Relations Office has a total staff of something like five men and nine girls. In addition to the usual news releases which it handles for the press, this office is responsible for M.I.T. participation in television and radio programs, and produces two periodical bulletins — one for M.I.T. personnel and the other for parents of M.I.T. students. In addition, it operates a Publications Office whose responsibility is to plan, design, and produce catalogues, reports, and other (non-Alumni) publications for the Institute.

An important public relations activity which has received the enthusiastic support of Alumni in various parts of the United States was inaugurated at Chicago in January, 1951, when the Institute staged its first Regional Conference. With the help of M.I.T. clubs, who assume responsibility for local arrangements, members of the Institute's Faculty and administrative staff meet with Technology Alumni

(*Continued on page* 162)

Whoever handles *liquid* . . .
Handles it better and safer
When he takes advantage of
SCULLY Signals, Gauges, Systems.

SCULLY SIGNAL COMPANY
174 Green Street, Melrose 76, Massachusetts
Flow Control Electronics

SPACE TECHNOLOGY

During the past year members of our staff have published a number of significant papers in the following fields:

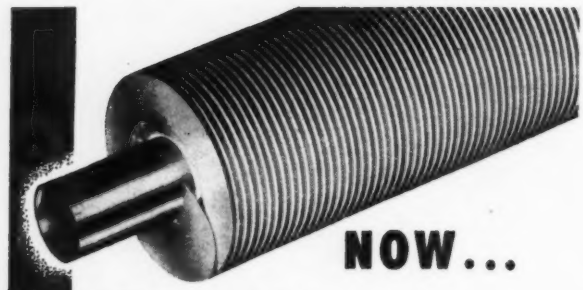
Electrodynamics
Nuclear Physics
Thermo-Nuclear Power
Magnetohydrodynamics
Solid State Physics
Communication Theory

A brochure listing these reprints may be obtained by directing your inquiries to Dr. Charles T. Morrow.

Space Technology Laboratories' role in the fields of Ballistic Missiles and Space Vehicles provides a medium through which scientists and engineers are able to direct their interests and abilities toward the solution of complex space age problems.

Inquiries regarding staff openings are invited. Write to Mr. James Benning.

Space Technology Laboratories, Inc.
P.O. Box 95001,
Los Angeles 45, California



NOW...

Even More
Heat-Exchange Capacity
Even Less **Air Friction**

with *AEROFIN*
Smooth-Fin
Heating and Cooling Coils

Write for Bulletin S-55

AEROFIN CORPORATION
SYRACUSE N. Y.

FREE BOOKLET TELLS WHAT CO_2 CAN DO FOR YOU

agriculture
chemistry
metals
electronics
refrigeration
food
drugs
textiles
rubber

There's practically no end to the important jobs that CO_2—combined with Liquid Carbonic savvy—is doing. Chances are this combination can come up with some surprising answers for you, too. For scores of CO_2 applications, covering all industry, send for LIQUID's new free booklet, "Applications Unlimited." Just use the coupon below.

MAIL THIS COUPON

LIQUID CARBONIC
DIVISION OF GENERAL DYNAMICS CORPORATION
135 South LaSalle St. • Chicago 3, Illinois
Send me my free copy of "Applications Unlimited."

Name_____
Company_____
Position_____
Address_____
City_____ Zone____ State____

DECADE IN REVIEW

(Continued from page 161)

and other leaders of industry and education for a full-day conference in a selected city. The theme of the program in the various cities varies, depending upon local industries and interests, but every effort is made to make the conferences educational, forward-looking, and sociable. As seen from the Cambridge point of view, new trends in education, research, technology, and related topics are major topics of these conference programs. Thus far, 13 Regional Conferences have been held; in order of their occurrence, in Chicago, Los Angeles, New York, Detroit, Dallas, Cleveland, St. Louis, Los Angeles, Tulsa, Chicago, Pittsburgh, Washington, D.C., and Albuquerque, and the 14th Conference is scheduled to be held in Detroit on January 31, 1959.

Alumni Activities

Between 1930 and 1947, the affairs of the Alumni Association were efficiently managed by an Alumni Secretary (who devoted part time to Association matters), a part-time Treasurer, and secretarial assistant. As the number and extent of alumni activities increased, full-time employees were required. Today, an Executive Vice-president (taking office January 1, 1947), a Secretary-Treasurer (appointed in 1948), and two secretaries are employed to administer the affairs of the Alumni Association.

The number of M.I.T. clubs has increased from 77 in 1948 to 94 today. Of the 17 clubs established in the last decade, an even dozen have been organized in foreign countries. A substantial number—more than half—of the M.I.T. clubs all over the world are visited each year by officers of the Alumni Association or by members of the Institute's Faculty or administrative staff. The number of living Alumni has grown too, from 41,438 in 1948 to 47,210 in 1955 when the last *M.I.T. Alumni Register* was published. On March 31, 1958, this figure stood at 48,949. To keep track of the Institute's large—and constantly moving—alumni body, the personnel in the Alumni Association Office has increased during the past decade, possibly as much as 50 per cent.

Alumni Fund activities, likewise, have increased. In marking the 10th anniversary of this Fund in 1951, the Association could be proud that 10,631 Alumni had contributed $166,280 to this Fund. For the fiscal year ending June 30, 1958, there were 13,331 Alumni who had contributed a total of $445,194 to this

(Continued on page 164)

"Precision-Gauged"
HAIRSPRINGS
More than 25 years' experience making all types of hairsprings for critical instrument applications. High volume production with absolute uniformity

PRECISION PRODUCTS COMPANY INC OF WALTHAM
WALTHAM 54 • • MASSACHUSETTS

SPECIALISTS in Pre-Fabricating PIPING

ALBERT
PIPE SUPPLY COMPANY, INC.

STEEL PIPE: Wrought Iron • Steel • Structural • Cast Iron • Copper-Steel • Electric Weld • Seamless • Spiral, Lap & Butt Weld • Shore-Dredge • Speed-Lay

CEMENT-ASBESTOS PIPE: For sewerage and water mains where corrosion is a problem.

ALUMINUM PIPE: In standard and light walls. All accessories stocked.

PLASTIC (PVC) PIPE

SPEED-LAY: Complete packaged PIPE SYSTEM for fast-laying, temporary and semi-permanent lines for water, compressed air and other services. Write for catalog.

VALVES, FITTINGS & FLANGES: Tube Turns • Dresser • Victaulic • Cast Iron or Steel • Forged Steel • Special Alloys • Water Main

PILING PIPE: Cast Steel and Iron Points • Plates and Shoes • Cast Steel • Malleable Iron Sleeves

COMPLETE FACILITIES for Bending, Coiling, Beveling, Swedging, Flanging, Grooving, Welding, Cutting to Sketch, and Threading to most rigid requirements. Bitumastic or Cement lining — Testing — all to Standard specifications.

S.G. ALBERT '29 • A.E. ALBERT '56

103-1 VARICK AVE., BROOKLYN 37, N. Y.
Tel.: HYacinth 7-4900

GAS STANDBY

Packaged 12 mcfh plant designed and built by Draketown for...

★ Utility or Industrial standby
★ Peak shaving and augmentation
★ 100% Town or plant supply

A Packaged Draketown Propane Plant will help you reduce demand charges; provide a supply of gas during curtailment periods... at the turn of a valve... or supply that outlying section or plant 100% if desired.

DRAKETOWN PROPANE PLANTS
"Good Gas Insurance"

If you have a gas problem, we can help you. We operate from coast to coast and overseas.
Phone or write today—no obligation.

DRAKE & TOWNSEND
INCORPORATED
Consulting • Design • Engineering • Construction
11 WEST 42ND STREET • NEW YORK 36, N. Y.

SPECIAL REPORT

Mr. HENRY H. COBB, JR. NEW YORK LIFE AGENT

at BIRMINGHAM, ALABAMA

BORN: October 8, 1920.

EDUCATION: Princeton University, A.B., 1943.

MILITARY: U.S. Army—First Lt., Field Artillery; Feb. 12, 1943–October 12, 1945; Distinguished Service Cross, Purple Heart. U.S. Army—Major, January, 1951–November, 1952.

REMARKS: After being released from active duty as an Army Lieutenant with an outstanding service record, Henry H. Cobb became associated with New York Life's Birmingham General Office. This was on October 13, 1945. He was recalled to active duty during the Korean War and returned to New York Life in 1952 to resume his career. Henry Cobb's enthusiastic approach to solving his clients' insurance problems and his congenial manner helped him roll up an impressive sales record—one which has qualified him for the Company's Presidents Council. In 1958 he was first to qualify for New York Life's new honor designation—Group Millionaire. He added to these honors by winning membership in the industry-wide Million Dollar Round Table of which he is a 1958 Qualifying and Life member. His performance thus far makes it possible for Henry Cobb to look forward to an even more distinguished future as a New York Life agent.

Note

Henry Cobb is now established in a career as a New York Life representative that is providing him with security, substantial income and the deep satisfaction of helping others. If you'd like to know more about such a career for yourself with one of the world's leading insurance companies, write:

NEW YORK LIFE INSURANCE CO.
College Relations Dept. L-26
51 Madison Avenue, New York 10, N.Y.

DECADE IN REVIEW

(*Continued from page 162*)

worthy cause. During the past two years, a Regional Director of the Alumni Fund has organized hard-working alumni groups to make personal solicitations in several scores of cities. Paid personnel working on Alumni Fund activities certainly must have doubled in the last decade.

Two conferences for Class Officers, and two for Class Agents, Special Gifts Chairmen, and other "working personnel" of the Fund have been held on the M.I.T. campus shortly after Labor Day for the past four years. Lasting a day and a half, these conferences provide a stimulating and active program for those who participate in them.

The Technology Review faces a steadily growing volume of reading material that must be processed each month. The amount of copy for each set of Class and Club Notes, alone, is equivalent to that of a full-length novel. Despite constantly rising costs, for more than a quarter of a century The Review has consistently more than earned its operating expenses, and its annual surpluses have helped to defray expenses elsewhere. There has been no increase in The Review's advertising or editorial staff since at least 1945. In addition to their Review duties, since 1949 the Business Manager has devoted a large part of his energy and time to the Institute's Development Program and, at the request of the Administration, its Editor has been responsible for producing a second monthly publication related to the Institute's research program.

Other M.I.T. Activities of the Decade

Obviously it is not possible to chronicle here all of the major events that have transpired at the Institute in the past 10 years, and which have engaged the attention of a steadily growing administrative staff.

Today, M.I.T. students engage in virtually all college sports, except intercollegiate football. M.I.T. has been especially strong in sailing and in rowing, and is fortunate in having the Charles River Basin at its doorstep. In 1947, the Institute hired its first full-time Director of Athletics, and an Athletic Board replaced the Alumni Advisory Council on Athletics.

As has long been true at M.I.T., students take part in all manner of hobbies and extracurricular activities. Perhaps the biggest change to develop in M.I.T. students, particularly in the last decade, has been their growing interest and strong participation in good music. The students' innate interest in music could be effectively nurtured as M.I.T. engaged a staff member for music appreciation in 1947. Of course many students have their own high-fidelity sound-reproducing systems and their record collections reflect a predominant interest in classical music. Students also participate enthusiastically in concerts in Kresge Auditorium. In recent years, the Choral Society has won international renown with two highly successful European tours, as recorded in the November, 1958, issue of The Review.

One might mention, too, the astounding growth of the Summer Session. No longer is summertime primarily a period for laggards to make up studies, or for the alert and ambitious students to gain advanced standing. Today, the Institute is about as busy during the summer months as it is in the regularly scheduled school year. But now summer courses generally cater to the needs of professional workers in industry. A score or more of special courses, conferences, and symposia are offered every summer, and each lasts from a few days to two weeks. Enrollment in the regular Summer Session (for M.I.T. students) has decreased fairly regularly from 2,146 students in 1948 to 1,548 students in 1957. There were 171 enrolled in the first special Summer Session in 1949, and this grew to a peak of 2,497 in 1956 and reached a more manageable figure of 1,757 in 1957, the last year for which data are published.

Worthy of mention, too, is the increased attention that has been given to all phases of student, Faculty, and staff health – especially in the fields of preventive and occupational medicine. Radiations of one kind or another produce potential hazards of a type not known a decade back on college campuses, and the deleterious effects of such radiations must be guarded against. Moreover, obnoxious waste products of many kinds must be properly and promptly disposed of.

Greater attention than ever before is also given to helping freshmen adjust themselves to college life at the Institute. Incoming students are more carefully

(*Concluded on page 166*)

BOSTON NEW YORK PITTSBURGH PORTLAND, ORE.

RELIABILITY EFFICIENCY 1895 EXPERIENCE

LORD ELECTRIC COMPANY

INC.

FOUNDER, F. W. LORD, M.I.T. '93

64 YEARS OF EXPERIENCE IN ELECTRICAL CONSTRUCTION

Nonlinear Problems in Random Theory

by Norbert Wiener

Fifteen lectures by the distinguished MIT mathematician that break new ground on the frontiers of applied mathematics. This is the first of the Technology Press Research Monographs, a new series designed to make some of the timely and important research studies at MIT more readily accessible to interested scientists and engineers. $4.50

The Scanlon Plan: A New Frontier in Labor-Management Cooperation

edited by F. G. Lesieur

The first book to appear on the Scanlon Plan, a plan designed for improving the productivity of both labor and management and for sharing the gains equitably. The book includes reports on how the plan is working in a dozen industries and evaluations by experts in industrial relations. $4.50

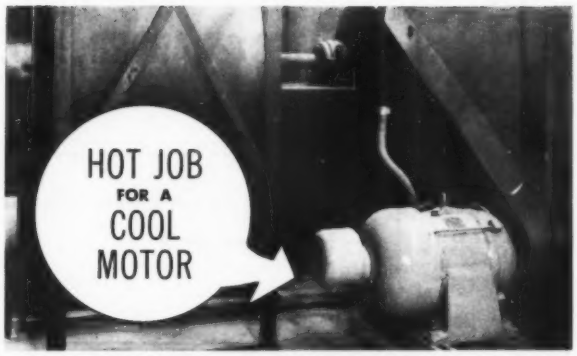
Random Vibration

edited by Stephen H. Crandall

A set of notes written especially for engineers who are already familiar with classical vibration theory and who need an introduction to the random vibration problem which has become so important in recent years in the design and testing of missiles, jet aircraft, and other vehicles subject to random loadings. $10.00

***Order from* The Technology Press**

Cambridge 39, Mass.



BROOK TOTALLY ENCLOSED, FAN COOLED, MOTOR DRIVES INCINERATOR DRAFT FAN.

An ideal application for this 30 HP Brook Totally Enclosed, Fan Cooled, Slip Ring Motor—built to resist heat or cold, dust, fumes, moisture. It is driving an induced draft fan handling washed flue gas and raw air at 350°F. in an American Incinerator Corp. system processing municipal waste. Brook A.C. Motors are winning praise in every industry for dependable service and overall economy. They can save for you! Warehouses, Sales Representatives, Dealers throughout the country. Send for literature.

world's most respected motor

BROOK MOTOR CORPORATION

3553 W. Peterson Ave., Chicago 45, Illinois

P. L. Loewe '31, V. P.

Since 1904

BROOK MOTOR

custom-built equipment for the mechanical and process industries
We develop special equipment and machines from ideas to blueprints — to prototypes — to pilot plants — to the final product or process. Our technical staff and plant facilities are geared to handle the most intricate jobs all the way from small scale laboratory equipment up to contracts in excess of $1,000,000.
Phone TWinbrook 3-6800 or write to:
Artisan METAL PRODUCTS, INC.
73 POND STREET, WALTHAM 54, MASS.
For a comprehensive summary of our work and the equipment we make, write for our brochure "Process Equipment".
Designers and manufacturers of
AUTOCLAVES · CONDENSERS AND HEAT EXCHANGERS · DISTILLATION EQUIPMENT · EXPERIMENTAL EQUIPMENT · EVAPORATORS · JACKETED KETTLES · MIXERS · PIPE, PIPE COILS, AND BENDS · REACTORS · SPECIAL MACHINERY · TANKS

SANGAMO ELECTRIC COMPANY

offers you a rewarding career

Sangamo Electric Company is one of the leading manufacturers in the fields of electrical measuring and control equipment, electronic components and military products. Sangamo's constant progress reflects the importance that Sangamo personnel place on the development, manufacturing and marketing of high quality products. These include electric meters, power capacitors, time switches, dynamotors, generators, electronic capacitors, recording instruments and military items. Besides the main plant in Springfield, others are situated at Marion, Illinois, Pickens, South Carolina, and in Canada, England and Scotland.

SANGAMO IS A GOOD PLACE TO WORK

Find out about your *opportunity* . . . ask your College Placement Officer, or write directly to Sangamo's Training Director.

These MIT men now hold key positions with Sangamo:

Edward A. Leach, Class of 1927
Vice-President in Charge of Engineering

Ray Ide, Class of 1930
Chief Chemist, Pickens Division

Herbert Johnson, Class of 1943
Chief Engineer

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS, U.S.A.

HOLMES & NARVER, INC.
ENGINEERS • CONSTRUCTORS

JAMES T. HOLMES M.I.T. '14
D. LEE NARVER STANFORD '14

828 S. Figueroa St., Los Angeles 17, California
Telephone MAdison 7-4337

SYSKA & HENNESSY, INC.
Engineers

John F. Hennessy '24 John F. Hennessy, Jr. '51

DESIGN • CONSULTATION • REPORTS
POWER PLANT • WASTE DISPOSAL • WATER SYSTEMS
New York City

CHAUNCY HALL SCHOOL
Founded 1828. The School that specializes in the preparation of students for the Massachusetts Institute of Technology.
Ray D. Farnsworth, *Principal* 533 Boylston Street, *Boston, Mass.*

meissner Engineers
consultants • engineers • constructors
Processing plants. Bulk materials handling and storage. Conveying systems. Ore and minerals processing. Bridge, expressway and interchange design.
JOHN F. MEISSNER ENGINEERS, INC.
300 West Washington Street
Chicago 6, Illinois
ANdover 3-1944
R. C. MEISSNER '43

LOCKWOOD GREENE
ENGINEERS—ARCHITECTS
Professional Service from Site Selection to Plant Completion
Plant Location Studies
Site Investigations
Complete Design
Supervision of Construction
REPORTS APPRAISALS
BOSTON, MASS.
New York 316 STUART ST Spartanburg, S. C.

ALEXANDER KUSKO, INC.
Consulting Engineers
141 Main Street Cambridge 42, Mass.
ELiot 4-1015
Research and Development in
Magnetics Transistor Circuits
Electric Machinery Control Systems
A. Kusko '44 J. P. Blake, Jr. '54
P. N. Hellam '51 J. A. Gaudet '56

DECADE IN REVIEW

(*Concluded from page 164*)

selected, not only by the M.I.T. Admissions Office, but also by a large group of loyal Alumni who form the Educational Council and, as ambassadors of good will, represent the Institute in their local communities. As a result of careful selection, there is a smaller number of students dropped because of their inability or failure to meet the Institute's high academic standards.

The growth of the Graduate School in the past decade has likewise been surprisingly rapid. Whereas 1,602 students, comprising 29.5 per cent of the total student body, were enrolled in the Graduate School 10 years ago, last year 2,515 graduate students were enrolled, and these made up slightly more than 40 per cent of the total student body. Ten years ago, 647 graduate degrees were awarded, and this number has grown to 851 in 1958. During President Killian's administration, 7,232 graduate degrees have been awarded by M.I.T.

Conclusion

Numerous other significant events might be selected for mention here in recounting achievements of the past decade. But space is a factor to be reckoned with in presenting this review. So, too, is time, for less than a week is available for the entire preparation of this review – from initiation of an idea to the completion of manuscript, illustrations, and layouts – and of course this survey is but a portion of The Review's editorial activities for the month. Action of the M.I.T. Corporation sets one time limit beyond which knowledge of anticipated events becomes a certainty, and the deadline for Review copy just happens to be scheduled for the same day that the M.I.T. Corporation meets!

The past decade at M.I.T. has been an exciting, intensely active one. President Killian, together with his Faculty and administrative staff, may look back on a distinguished record of outstanding achievement, and all can take pride in the results accomplished. Dr. Killian's present assignment in Washington is one of international significance and cannot help but have a wide and beneficial influence on the nation's educational and science programs. Alumni will follow his career with intense interest, patiently awaiting his return to M.I.T., and confident in the knowledge that his future contributions will continue to have utmost significance.

PROFESSIONAL CARDS

JACKSON & MORELAND, INC.
JACKSON & MORELAND INTERNATIONAL, INC.
Engineers and Consultants

ELECTRICAL—MECHANICAL—STRUCTURAL
DESIGN AND SUPERVISION OF CONSTRUCTION
FOR
UTILITY, INDUSTRIAL AND ATOMIC PROJECTS
SURVEYS—APPRAISALS—REPORTS
MACHINE DESIGN—TECHNICAL PUBLICATIONS

BOSTON NEW YORK

EADIE, FREUND & CAMPBELL
CONSULTING ENGINEERS

500 FIFTH AVENUE NEW YORK 36, N. Y.

Mechanical — Electrical — Sanitary
Air Conditioning — Power — Process Layouts

James K. Campbell '11

METCALF & EDDY
Engineers

Water, Sewage, Drainage, Refuse and
Industrial Wastes Problems
Airports, Laboratory, Valuations
Statler Building, Boston 16, Mass.

THE KULJIAN CORPORATION
Consultants • Engineers • Constructors

UTILITY • INDUSTRIAL • CHEMICAL

Power Plants (Steam, Hydro, Diesel), Textile Plants,
Water & Sewage Works, Oil Refineries, Pipe Lines,
Army & Navy Installations, Air Fields, Hangars

H. A. Kuljian '19 A. H. Kuljian '48
1200 NO. BROAD ST., PHILADELPHIA 21, PA.

FABRIC RESEARCH LABORATORIES, INC.

Research, Development, and Consultation
In the Fields of Fibrous, Organic, and Related Materials

1000 Providence Highway Dedham, Mass.
(At Route 128 and U.S. 1 Interchange)

W. J. HAMBURGER, '21 K. R. FOX, '40 E. R. KASWELL, '39

GILBERT ASSOCIATES, INC.
ENGINEERS AND CONSULTANTS

Malcolm G. Davis '25, *Vice President*
Allen W. Reid '12 E. C. Edgar '35

Steam, Hydro, Diesel, Nuclear Power Plants; Industrial Structures; Plant Safety, Utility Rates, Valuations, Reports; Purchasing; Chemical Laboratory

New York • READING, PA. • Washington

LAUREN B. HITCHCOCK ASSOCIATES
Chemical Engineers

Industrial Research & Development
Technical & Economic Evaluations
Acquisitions of Processes and Plants
Commercial Chemical Development—Air Pollution Control

Lauren B. Hitchcock '20 Technical Advisor, John H. Schaefer '26
60 East 42nd Street ..... New York 17, N. Y.

FAY, SPOFFORD & THORNDIKE, INC.
Engineers

Airports, Bridges, Express Highways
Water Supply, Sewerage and Drainage Systems
Port and Terminal Works
Industrial Plants Incinerators

Designs Investigations
Supervision of Construction

Boston, Massachusetts

CLEVERDON, VARNEY & PIKE
Consulting Engineers

HERBERT S. CLEVERDON '10 WALDO F. PIKE '15
JOHN A. DOW '23 HAROLD E. PROCTOR '17

Structural Designs Foundations
Heating, Ventilating, Electric and Plumbing Designs, Industrial Buildings, Reports, Investigations

120 TREMONT STREET BOSTON 8, MASS.

MAURICE A. REIDY
Consulting Engineer

BRIDGES BUILDINGS
STRUCTURAL DESIGNS FOUNDATIONS
CONSTRUCTION CONSULTANT AND ARCHITECTURAL ENGINEER

Estimates and Appraisals

101 TREMONT STREET BOSTON, MASS.

CHARLES NELSON DEBES AND ASSOCIATES
ENGINEERS AND ARCHITECTS

Structural, Electrical, Mechanical, Acoustical
Industrial, Commercial and Municipal Projects

915 EAST STATE ST. ROCKFORD, ILL.
C. N. DEBES '35

MORAN, PROCTOR, MUESER & RUTLEDGE
CONSULTING ENGINEERS

Foundations for Buildings, Bridges and Dams;
Tunnels, Bulkheads, Marine Structures, Soil Studies and Tests; Reports, Design and Supervision

WILLIAM H. MUESER '22 PHILIP C. RUTLEDGE '33
415 Madison Ave., New York 17, N. Y.

BREWER ENGINEERING LABORATORIES
Consulting Engineers

Electric Strain Gage Testing • Stress Analysis
Strain Gage Amplifiers • Strain Gage Switches
High Temperature Strain Gages

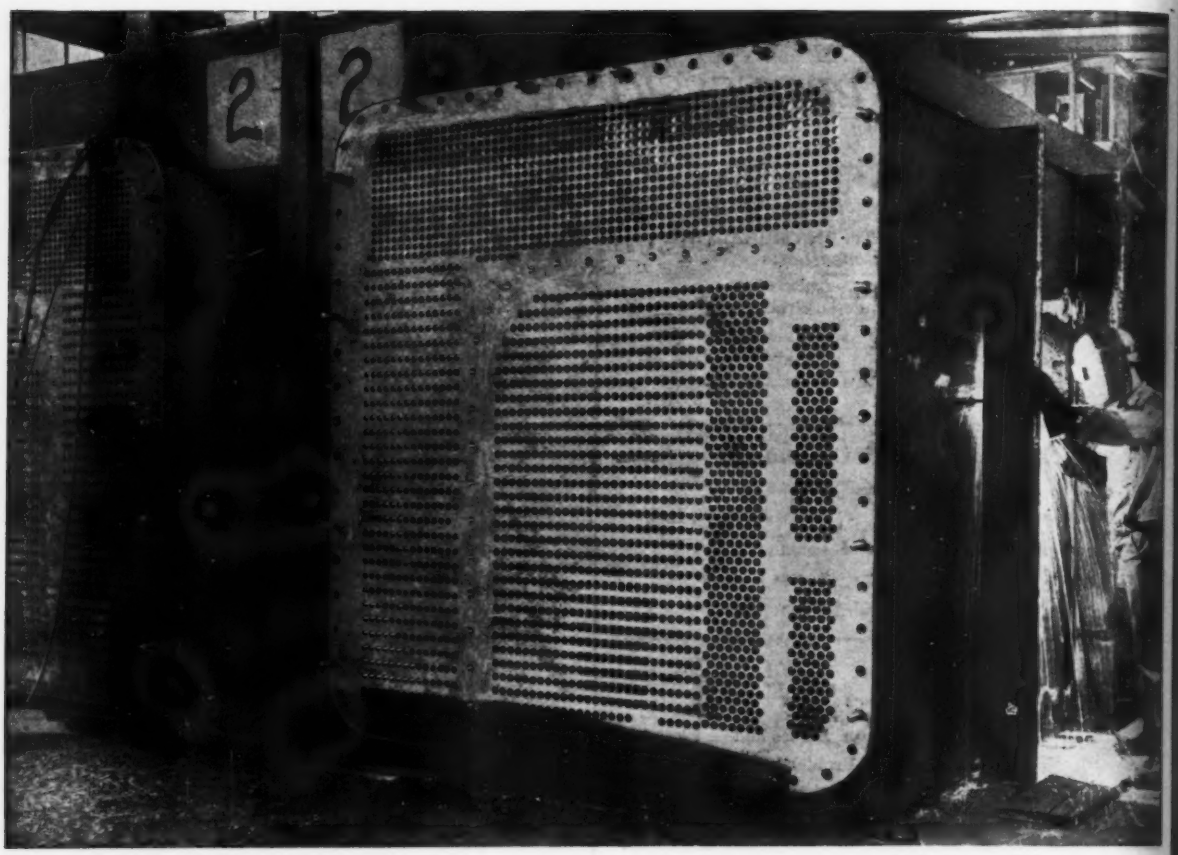
MARION, MASS. TEL. 103
G. A. Brewer '38 S. P. Cammack '57

CAPITOL ENGINEERING CORPORATION
CONSULTING ENGINEERS
DILLSBURG, PENNSYLVANIA

Highways Reports
Airports Surveys
Water Supply Design
Sewage Treatment Construction Supervision
Bridges Soil Testing

Branch Offices

Rochester, N. Y. Saigon, Vietnam
Robert E. Smith '41, Vice President



C.H. Wheeler Reverse Flow Condenser prior to installation at Savannah Electric & Power Company's Riverside Station. Reverse Flow principle could save Savannah hundreds of dollars: leaves, twigs, algae and other foreign matter can be flushed from tubes and tube sheets without shutting down the unit.

BECAUSE Reverse Flow design eliminates hours of costly down time

C.H. WHEELER CONDENSERS SAVE YOU MONEY

Let's suppose the condenser tubes and tube sheets in your station become clogged. If your condenser is of conventional design and serves a 200,000 kw turbine, you'd need many hours to clean the tubes, and each hour you spend could cost as much as $330!*

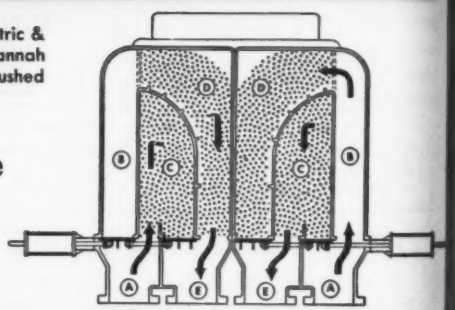
But with C.H. Wheeler's Reverse Flow design, you could flush away debris in a few minutes without shutting down the Condenser!

Reverse Flow is only one of the features of C.H. Wheeler Dual Bank Surface Condensers which save you money. Other money-saving features which result from Wheeler's 55 years experience in designing and building Condensers and auxiliaries, include better tube sheet design and advanced engineering of Tubejet® Steam Jet Ejectors, Condensate Pumps and Circulating Pumps.

*Based on an estimated cost of $8,000 per day for shutdown of a 200,000 kw Turbine-Generator.

C.H. WHEELER SAVES YOU MONEY IN THESE WAYS, TOO:

- Pure condensate
- Lower absolute pressure, higher vacuum
- "Zero" condensate temperature depression
- Deaeration to 0.03 cc. of oxygen per liter. (Special design provides for deaeration to 0.01 cc. per liter.)



HERE'S HOW THE "REVERSE FLOW" PRINCIPLE WORKS

Left Side Shows Normal Operation: Water enters inlet A with right port open, flows through tube bank C to rear of condenser; then it returns through tube bank D to front of condenser and discharges at point marked E.

Right Side Shows Reverse Flow: Sluice gates move on a common stem. Water flows up through channel B, through tube bank D to rear of condenser; returns through bank C to front of condenser.

In the C.H. Wheeler Divided Water Box design each half of the condenser can be back-flushed independently of the other; or both halves can be back-flushed simultaneously, with one or two circulating pumps operating.

C. H. WHEELER MFG. CO.

19th and Lehigh Avenue • Philadelphia 32, Pennsylvania

Whenever you see the name C.H. Wheeler on a product, you know it's a quality product.

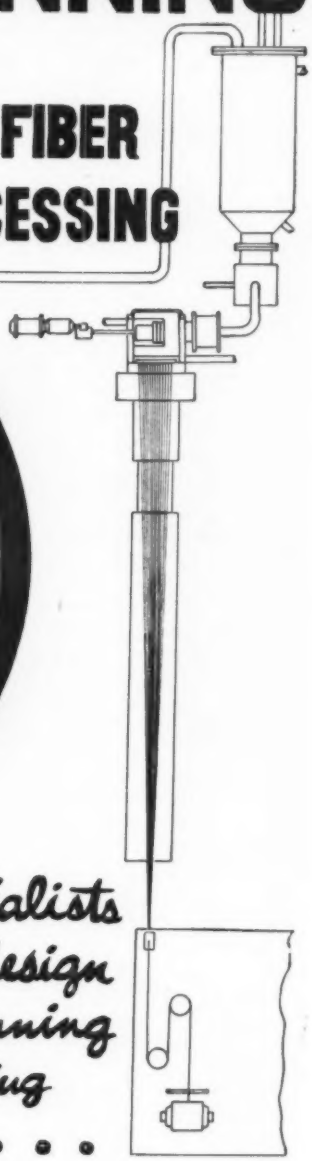
Steam Condensers • Steam Jet Vacuum Equipment • Centrifugal, Axial and Mixed Flow Pumps • Marine Auxiliary Machinery • Nuclear Products

Products

REVIEW

CH
PR
DE

SPINNING
and
SYNTHETIC FIBER PROCESSING



UHDE

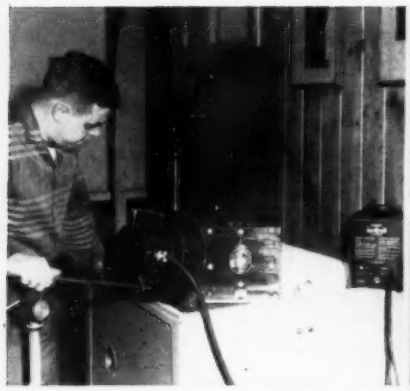
Specialists in the over-all design of complex spinning and handling equipment . . .

Let us apply production experience to your process problems

CHEMICAL PROCESS DESIGN

THE *UHDE CORPORATION*

350 FIFTH AVENUE, NEW YORK 1, N.Y.
8204 Empire State Building



Rotron Research Corp. of Woodstock, N. Y., uses several dozen Strobotacs continuously in the design and production testing of its small fans and blowers, which are used in the cooling of electronic equipment. Typical tests include:

During vibration testing, Strobotac and Strobolux® auxiliary light source spot mechanical resonance present in a developmental vane-axial blower.

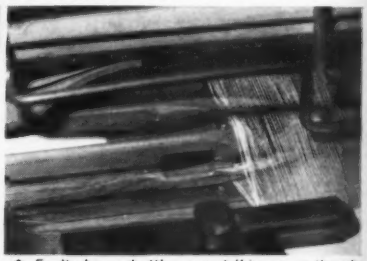
Motor-speed measurements under various loads imposed by dynamometer during production testing.

Measuring motor speed during air-moving capacity test of experimental fan in a standard NAFM test chamber.

OTHER INDUSTRIAL USES FOR G-R STROBOSCOPIC EQUIPMENT . . .

◀ A Strobolux in use at a typical paper mill helps observe water removal and sheet formation on a Fourdrinier wire.

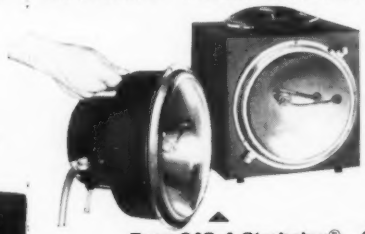
Checking spindle speeds to an accuracy of ±1% at textile mill. ▶



▲ Faulty loom shuttle seen striking warp threads with aid of a Type 1532-B Strobolume.

STROBOTAC® *Industry's Most Versatile Tachometer*

- ★ Measures speed from 60 to 100,000 rpm.
- ★ Makes rapidly rotating, reciprocating, or vibrating objects appear in slow motion.
- ★ No physical connection between Strobotac and object under study no drag or retarding effects imposed.
- ★ Permits maintenance checks on machinery, minimizing costly down time.



Type 648-A Strobolux®...$300
An auxiliary white-light source with an intensity 100 times that of Strobotac. Flashing rate up to 6000 flashes per minute. Must be flashed from Strobotac. Can be used for single- or multiple-flash photography.

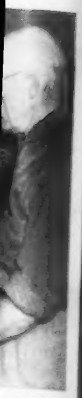
Type 631-BL Strobotac® . . . $170
Versatile, basic stroboscopic light source — flashing range; direct reading from 60 to 14,400 rpm; useful as electrical tachometer from 60 to 100,000 rpm, and from below 300 rpm to 100,000 rpm for slow-motion studies. One control adjusts flashing rate to desired value; dial readings accurate to ±1% over most of range. Operates from 115v a-c line.

Type 1532-B Strobolume...$275
A high-intensity white-light source 400 times as intense as the Strobotac for studies of looms and other low-speed machinery. Flashing rate up to 1200 flashes per minute, or up to 3000 per minute at reduced intensity. Flashing rate controlled by Strobotac, Type 1535-B Mechanical Contactor ($150), or any other make-or-break mechanism. Strobolume can be used for single- or multiple-flash photography. Cord with push button provided for manual control of flash.

STROBOTAC®

Manufactured Exclusively by

GENERAL RADIO Company 275 Massachusetts Avenue, Cambridge 39, Massachusetts



n testing

ng capacity
NAFM test

o threads

er

. $300
an inten-
hing rate
e flashed
ingle- or

$170
ource
om 60
tach-
and
m for
l ad-
dial
ost of

sets